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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

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The Big Lift

SO much has lately been written about VTOL, especially in connection with the Short SC.1, that one could almost be forgiven for envisaging this technique as something that will become a commercial proposition only in the fullness of time. The fact is, of course, that in the heavy-lift helicopters represented by the Westland Westminster and Sikorsky S-60 we already have the tools wherewith to set about a job that could cause a minor—perhaps even a major—revolution in bulk transport. The prospect holds a unique fascination, for sounding more loudly day by day are the respective challenges of air-cushion vehicles, hydrofoils, monorails and other novel means of locomotion.

Just as packaging seems to be the trend in many aspects of modern life, with the object of simplifying, expediting and protecting, so it is seen also as the natural partner of the heavy-lift helicopter, now considered in its commercial form, as distinct from the military crane/transporter. The idea of the pod, package, pannier, or nacelle, having a skeletal helicopter carrier vehicle, is not by any means a new one; but its practical possibilities have only recently been realized. The delightful story of Mr Igor Sikorsky's literally breathtaking perambulations round the underslung platform of an S-60 preparatory to the fitting of a pod was recounted in an article in our "Helicopters of the World" special number dated May 27 last. Already a 20-passenger "people pod" is in use on the S-60 and Mr Sikorsky sees "a big future" for such containers. One of his pet ideas, and one that cannot be dismissed any more readily than can his enduring achievements, is the use of the pod helicopter not only as a transport between a city centre and a supersonic airliner waiting at a runway's end, but as a crane for lifting a supersonic airliner from a rooftop platform in a city and launching it on its way. For the more immediate future, however, it will be people, luggage, freight and cars that will form the cargoes for the great aerial tugs.

The Car Case

Our present thought (stimulated by the news of a Blackburn project on page 38) is the "car case"—as the design office will already be calling it, in their professional parlance. (Suggesting, incidentally, the adoption of "carcase" as a new aero/auto term before "autopod" is allowed to gain currency.) Commercially, the significance of the project is the rapid picking-up and setting-down of 90 passengers and 18 cars, or 250 passengers, in a pre-loaded nacelle. A speed of 170 m.p.h. might be maintained for 100-350 miles; the tug might cost £400,000 in production and the pod £50,000. The status of the project remains for the present indeterminate; but the continuing interest of the Hawker Siddeley Group (which now controls the Blackburn company) adds greatly to the possibility of our seeing a new family of British transport vehicles, developed specifically for the type of short-range heavy-lift operations which have seen their first successful commercial exploitation across the English Channel.

All this, as we have indicated, remains for the present a little nebulous. But there is nothing nebulous—however skeletal the actual vehicle might appear—in Westland's private venture into the heavy-lift field with their two Westminster prototypes; and we may be sure that the new transport technique that has lately gained publicity in connection with the Blackburn project has not passed unconsidered in the project office at Yeovil. As distinct from the Rotodyne VTOL airliner, with its sustained cruising speed of 200 m.p.h. or more, the Westminster and its possible derivatives are heavy-lift helicopters in the true sense.

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FIRST OFFICIAL VISITOR to see the Avro 748 was Mr Krishna Menon (right) seen discussing the new transport with Sir Roy Dobson. The aircraft made its first flight on June 24 and was fully described in our issue of June 3

Exports: £1,000m

SINCE the war, the British aircraft industry has exported products amounting in value to £1,007,075,403. Of this total, the sale of engines abroad earned £314,619,023. These figures were achieved by the end of May, which had an exports total of £13,211,136. This brought the figure for the first five months of 1960 to £65,028,220—equivalent to an annual figure of £156m.

May's total was made up as follows: aircraft and parts, £5,646,725; engines, £7,037,132; electrical apparatus, £248,821; aeronautical instruments, £175,183; tyres, £103,275. Leading customers for aircraft were the United States (£922,948) and Egypt (£526,326), and for aero-engines the US (£1,571,099) and France (£1,212,004).

The £1,000m figure for exports since the war does not include royalty payments for overseas manufacture, under licence, of British aircraft, engines and equipment; nearly 50 agreements have been signed in recent years with 14 countries, covering 11 basic types of aircraft and 14 types of engine. Nor does it include the value of all products sold abroad by the 574 member companies of the SBAC: it excludes undercarriages, flight refuelling equipment, gun-sights, parachutes and ejection seats, to name but a few items among products which have earned many more millions in overseas currency. Dowty sales of undercarriages, pumps, accessory drive equipment, propellers, hydraulic and electrical components have totalled more than £12m; Lucas fuel systems, £8m; Ultra Electronics rescue and inter-communication equipment, £5m; Martin-Baker ejection seats, £4½m; and Sperry automatic pilots, gyro horizons and Gyrosyn compasses, £3m—to quote some examples.

Sud Frelon Progress

ONE of the two prototypes of the Sud Frelon helicopter, powered by three Turboméca Turmo IIIB free turbines, has now been handed over for official testing by the Centre d'Essais en Vol at Brétigny. Manufacturer's tests to date have shown that the top speed of the Frelon is 153 m.p.h., cruising speed, 144 m.p.h. and speed on two engines over 125 m.p.h. Three-engined ceiling at 15,400lb weight is 12,450ft and on two engines at the same weight, 7,870ft. The Frelon has flown at 17,150lb weight and at heights of over 13,000ft and has carried a slung load of 2,420lb. Autorotational descents and considerable two-engined time have been completed, the longitudinal and lateral c.g. limits have been established and "smoke-screens have been laid" (a performance that is not explained).

Sud add that the Frelon will hover hands-off for more than a minute under control of its SFENA autostabilizer and that the Turmos have behaved extremely well and proved reliable and easy to start. The definitive version of the Alouette III, powered by an Artouste IIIB, has also been sent to the CEV and recently made a series of landings on the summit of Mont Blanc.

V-Bomber Crew Ejection

A SERIES of trials by Martin-Baker Aircraft Co Ltd was successfully concluded last Friday when Mr W. T. H. Hay made a successful live ejection in a rearward-facing seat from the crew compartment of a Valiant of Bomber Command Development Unit. Many dummy tests preceded the live ejection. It has now been satisfactorily demonstrated that rearward-facing ejection is practicable and the decision must be taken whether V-bombers will be modified to provide ejection seats for all crew members.

The ejection gun and charges used in the tests were of the normal kind, but the longer seat rail, required to guide the seat from well inside the fuselage, provided a better ejection trajectory and Mr Hay cleared the fin of the Valiant by about 50ft. The seat itself, although it incorporated several modifications, was externally similar to standard Mk 4 models and included leg restraint.

SUCCESSFUL CULMINATION of tests to prove rearward-facing ejection from V-bombers with a Martin-Baker seat is the subject of a news-item above. Seen, l. to r., at the live test, are Wg Cdr H. B. Hunt, AVM M. E. M. Perkins, Mr W. T. H. Hay, AVM T. A. B. Parselle, Mr James Martin and Wg Cdr K. G. Hubbard

FROM ALL QUARTERS

RB-47 Lost

ON July 1 contact was lost with a Boeing RB-47K reconnaissance aircraft temporarily detached from Forbes AFB to RAF Brize Norton, Oxon. Its last reported position was given as 73°N 35°E (another report claimed a different location) over the Barents Sea some 500 miles north of Murmansk. The aircraft, with a crew of six USAF officers, was stated to be engaged in electronic reconnaissance; possibly this involved the recording of Soviet radio and radar transmissions, as well as investigations into the Aurora Borealis in connection with the BMEWS system.

As we go to press there is still no news of the aircraft, despite an intensive sea and air search, the latter based chiefly on the NATO airfield at Bodø, Norway. A Russian rescue cutter, *Kapitan Afanasiev*, is also engaged in the hunt. In Washington the Assistant Defense Secretary, Murray Snyder, said he was sure there had been "no deliberate attempt" to cross the Soviet frontier.

Soviet Helicopter News

THE Russian helicopter designer Mil has given particulars of a new "popular" helicopter called the Moskvich, after the Soviet "people's car." The idea was originated by Mr Krushchev himself, who was delighted when he was flown in an Mi-4 direct from Vnukovo Airport into the heart of the Kremlin. The Moskvich has been developed from the very extensively used Mi-1 and carries pilot and three passengers in a soundproofed cabin in which normal conversation is said to be possible. The rotor blades are all-metal and hydraulic controls are provided. An amphibious variant will be available. The Russian designer is reported to have said that the Mi-1 has been supplied to Poland and 17 other countries.

Also reported is Malyutka ("The Little One"), a three-seater said to be largely based on the design of Nikolai Kamov's Ka-18. An ambulance version would carry a stretcher case and a doctor.

From New Delhi comes news that the Indian Prime Minister, Mr Nehru, inspected an Mi-4 which had been specially flown there for demonstration. India is looking for a high-altitude helicopter to ferry men and supplies to isolated mountain outposts on the Tibetan border, and the Russians consider the Mi-4 to be ideally suited for the requirement. It is understood that the Russians have offered to accept payment in Indian currency.

Manpowered Flight at Westminster

SPEAKING in an adjournment debate in the House of Commons on June 29, Mr William Teeling asked for Government aid for the development of manpowered aircraft. For about £12,000, he suggested, production of a prototype should be possible. In support of his request Mr Teeling quoted the possible advantages of new low-speed knowledge applicable to conventional aircraft, and a security advantage which "could be immensely useful, offering possibilities of flying from submarines or elsewhere in such a way that radar could not detect us."

Private enterprise, Mr Teeling claimed, was doing all that it

***DIRECTORS** of the new British Aircraft Corporation toured the aircraft and guided weapons divisions of English Electric Aviation (one of the four Companies owned by the Corporation) on June 28 and 29. L. to r., Lord Caldecote, managing director of English Electric Aviation and executive director for guided weapons of B.A.C.; Mr F. D. Crowe, chief engineer of English Electric Aviation's aircraft division; Mr R. P. Beamont (partly hidden), manager of flight operations and a special director of English Electric Aviation; Sir Reginald Verdon Smith, a director of the Corporation, and Major General Sir Charles Dunphie, a deputy chairman. Note the Flight Refuelling probe*

could to help. "These things have now reached the stage where they should be developed, but it all costs money," he continued. "A prototype of a really good pedal-type of manpowered aircraft would cost anything in the neighbourhood of £8,000 to £10,000."

Replying, Geoffrey Rippon, Parliamentary Secretary to the Ministry of Aviation, said that he thought that flying from submarines was "a little far in the future." In the absence of any foreseeable military use, it was difficult for the Government to undertake to give any direct financial support. After reviewing the Hartman and Perkins manpowered aircraft, Mr Rippon added: "I might say that hon members who are interested in these matters can find further details and photographs of these projects in the issue of *Flight* of October 30, 1959."

S. G. Brown Directors

NEW directors of S. G. Brown Ltd, whose sale to D. H. Holdings Ltd (in association with the American Bosch Arma Corporation) was announced last month, have been named as follows:—Sir Aubrey Burke, chairman; Mr F. W. Gale, managing director; Mr D. F. Devine and Mr C. T. Foss (representing Bosch Arma); Mr A. S. Kennedy (de Havilland); Mr C. W. Perelle (Bosch Arma); and Mr H. G. Sturgeon (de Havilland).

Morane to Produce the Rallye

FOLLOWING an extensive sales demonstration and market survey in France during recent months, Morane Saulnier have decided to start mass-production of the little three-seater, all-metal Rallye. Orders are flowing in and the first production machine will emerge "at the end of the first quarter of 1961." The first batch will be of 250 aircraft, the rate of production working up to no less than 45 a month—two per working day.

The Rallye, which was first seen in public at the Salon in Paris last year, would hardly be economic to produce in small numbers and the decision to launch so large a batch may well prove a turning-point in European light-aircraft production.

Norman Ryder

THE death occurred on June 29, following a heart attack, of Mr Norman Ryder, deputy chief public relations officer of BEA. He was 62.

From the editorial staff of *Flight*, which he joined in 1940, Norman Ryder went to BEA public relations in 1947, where he played a leading part in establishing the PR office during the difficult years of controversy over public ownership. Before the war he was air and motoring correspondent of the Wolverhampton *Express and Star*. He was well known for his cheerful personality, integrity and news sense.

At Deauville

MEMBERS of the Royal Aero Club once again had M and Mme André to thank for a delightful July 2-3 weekend as their guests in Deauville following on a smaller but similar affair at La Baule.

To those who have enjoyed previous Deauville rallies the sight of seventy to eighty light aircraft—this year it was 74 including the Rapides, carrying nearly 300 guests—on the field ahead of the apron, their colours vivid in the shimmering sunshine, still brings a thrill as well as a reminder of splendid lunches and gala balls at the Royal and Golf Hotels and at the Casino. Weather this year was beautiful throughout. The arrival competition was won by the Westoby's Rapide, second prize going to L. R. Snook in a Comanche. Prizes for remarks on landing went to Arnold Wilson (Gemini), John Dyke's Proctor V and to Mrs Betty Heycock, wife of the British Air Attaché in Paris. Principal speeches of welcome and thanks were made by Col C. F. H. Gough for the Royal Aero Club and M Jacques Allez for the French Aero Club.

IN BRIEF

The Duke of Edinburgh has accepted honorary membership of the Glamorgan Flying Club.

The new Hiller E4, described as a "station wagon" business-executive helicopter, was displayed publicly for the first time on June 30 in San Francisco. It seats four.

Sir Frederick Handley Page was last Tuesday being presented by the German Wissenschaftliche Gesellschaft für Luftfahrt (Scientific Society for Aeronautics) with its highest award, the Ludwig-Prandtl Gold Ring. He is only the second non-German to receive this honour.

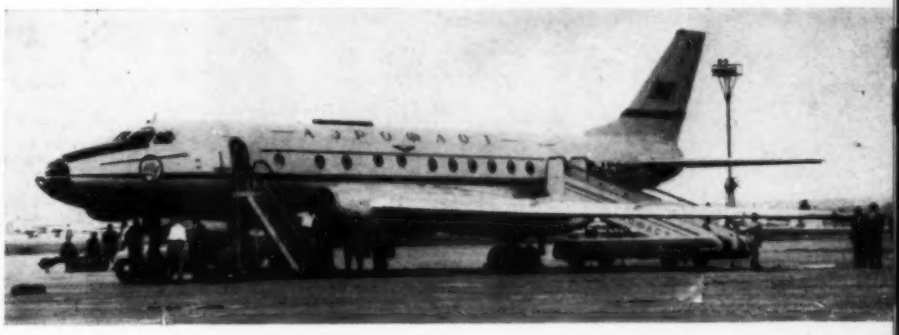
Mr Morien B. Morgan, CB, a former Deputy Director of the RAE and at present Scientific Adviser to the Air Ministry, has been appointed Deputy Controller of Aircraft (Research and Development) at the MoA. He succeeds Dr W. Cawood, CB, CBE, whose appointment as Chief Scientist to the War Office was recently announced.

As is briefly noted on page 41, Rolls-Royce—assisted by engineers from other firms, including Bristol Siddeley—has finally traced the cause of the compressor-disc failure which has since May 23 grounded the Tyne turboprop. Heat-treatment of the original disc forging was found to be at a temperature which did not sufficiently relieve the internal stresses caused by quenching, resulting in local running stresses beyond design values. Selected discs (presumably with little residual stress) are now being built into the Mk 506, 512 and 515 engines for shipment to Vickers and Canadair.

A new helicopter long-distance record was set up on June 24 by Fyodor Belushkin, according to Moscow radio. Flying an Mi-1 he made a non-stop 1,000km flight over a closed circuit in 7hr 7min 9sec, covering the Tushino - Kaluga - Vyazma - Tushino route twice. The report said he was the first man in the world to average a speed of 141.392km/hr over a distance of 1,000km in a helicopter. The existing distance record (555.376km) was set up by another Russian, V. Riakhovsky, in 1958.

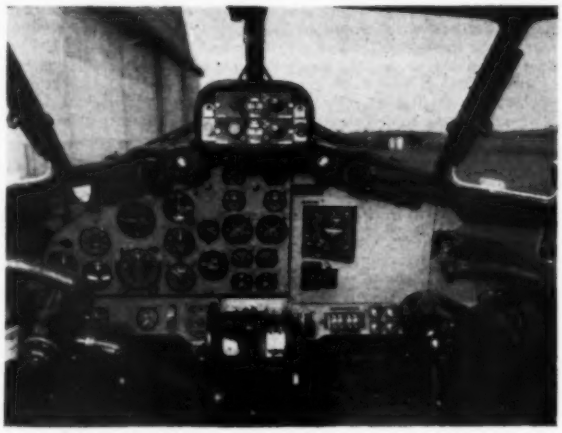
A US Army mission is evaluating the Morane Saulnier 1500 Epervier in France and further trials may be carried out in America later. The Nord 2506 assault transport version of the Noratlas has been tested and demonstrated in France. It has tip-mounted Marboré boosters, high-lift flaps and main undercarriage oleos which can be locked or collapsed for easy loading. In compiling our review of military aircraft we reasonably assumed that both these projects had been abandoned. The above news has only just been announced.

(*Further "From All Quarters" news overleaf*)



***TURBOFAN TUPOLEV:** First picture of the Tu-124 forty-four seater, subject of a news item on page 37*

DOVE 8 features visible in the picture at left include the aerodynamically improved canopy and the ejector exhaust system (see news-item below). The cockpit picture shows the neat light-background instrument arrangement. Airline-standard radio seen here includes Bendix 21-series VHF and Marconi AD.722 lightweight ADF



FROM ALL QUARTERS . . .

Dove 8 Announced

THE de Havilland Dove, which went into production in 1946, has unquestionably joined that select band of aeroplanes that, based initially on a design conceived with real foresight and then appearing in successively improved marks, continue to find a ready market year after year.

Announced by the manufacturers last week—though some advance publicity had previously appeared in America and elsewhere—was the Dove 8, in which the emphasis is on its suitability as an executive aircraft, apart from the light commercial work with which Doves have so long been associated. Increased performance is conferred by two improved Gipsy Queen 70 Mk 3 engines, which, with new low-drag cowlings and the well-tried D.H. 1,000-size fully feathering c.s. propellers, give a range of operating speeds from 182 m.p.h. for long-range cruising to 210 m.p.h. for shorter sectors. Rated at 400 h.p. for sea-level take-off, the new engines have ejector exhausts and a new power-priming system for easier starting (and incidentally obviating fuel lines terminating in the cockpit).

Up to six passengers, in addition to pilot and co-pilot, "can be carried in extreme comfort," and a wide choice of cabin styling and furnishing is offered. On the US market, where the Dove 8 will be known as the Dove Custom 800, interiors will be provided to customers' requirements by a specialist firm.

A new cockpit canopy allows certain items of equipment to be conveniently roof-mounted and yet gives increased headroom. The instrument panel and its lighting system have been redesigned, a new type of pneumatic brake control has been introduced to facilitate taxying, and provision is made for installation of the new lightweight radio and navaid equipments now available.

S. T. A. Richards Retires

AFTER a lifetime of service in the British aircraft industry, spending the last 32 years continuously with Westland Aircraft and Normalair Ltd, Mr S. T. A. Richards has retired. He is 65 and had since last year been patents engineer of Normalair Ltd, the company he helped to found in 1946.

Mr Richards' first experience of the aircraft industry was gained with Handley Page Ltd (1916-25); then he had three years with Parnall Aircraft and in 1928 joined Westland as a senior designer. One of the early Westland machines with which he was concerned was the Pterodactyl; then during the Second World War, as assistant chief designer, he was responsible for the design and development of cabin pressurization equipment for the Welkin. In 1946 he became chief designer of Normalair Ltd, and from 1954 to 1959 was special-products engineer, one project on which he was engaged being the development of one of the first full-pressure suits for use in high-altitude aircraft.

Avions Fairey Directors

THERE have been new appointments to the board of Avions Fairey SA, Belgian member of the Fairey group of companies, following the retirement of Mr Richard Fairey (chairman) and Mr E. O. Tips (managing director). Mr Geoffrey W. Hall, chairman of the Fairey Co Ltd, is now also chairman of Avions Fairey. Mr Arthur Talbott, who has been with Fairey since 1940 and was made a director of Avions Fairey in 1956, becomes managing director; and the new board is completed by three directors from the parent company, Mr J. C. Macpherson, Mr A. Vines and Mr C. C. Vinson.

Mr Talbott

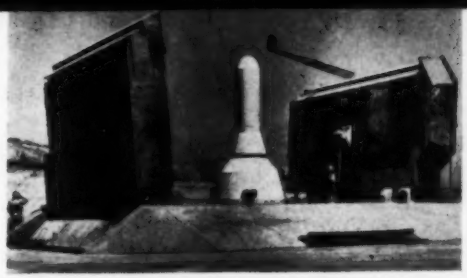
Avions Fairey SA, at Gosselies, is currently engaged on bomber and fighter/bomber overhaul and repair contracts for the Royal Belgian Air Force and French Air Force. It produces the Avions Fairey Tipsy Nipper and is negotiating a major contract with the Belgian Government for NATO production of Lockheed F-104G Starfighters.

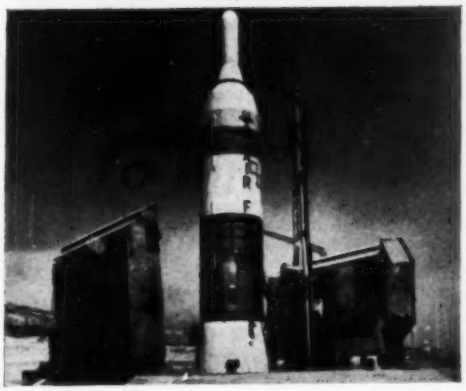
Biggin Birthday Party

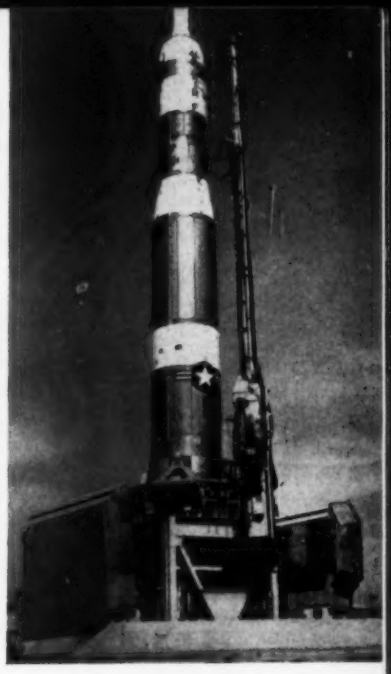
TOMORROW, July 9, will be celebrated the first birthday of Biggin Hill as a private and executive aircraft centre. The occasion is to be marked by the opening of a new airport control tower by the Right Hon Miss Pat Hornsby-Smith, MP, and owners of aircraft are invited to a "fly in" for the occasion. It is unfortunate that the date clashes with the air races and aerobatic contest at Coventry (see page 75).

ASSORTED TRIO from No 229 OCU, Chivenor—a Hunter F.4 with Hunter T.7 to starboard and Meteor T.7 to port. The picture was secured by "Flight" photographer Ian Macdonald over Bull Point, near Ilfracombe, on the north Devon coast

Missiles and Spaceflight







These photographs are the first to be released showing a Martin Titan ICBM being raised from its underground silo (in this case at Vandenberg AFB). The launcher system is the responsibility of American Machine & Foundry Co, who last week were awarded a further $81.6m contract for 36 new launcher systems, for Ellsworth, Mountain Home, Larson and Beale AFBs (nine operational silos per squadron)

STILL HOPE

Although the Government's announcement of the part which the British Commonwealth will play in space research has yet to be made, the Minister of Aviation, Duncan Sandys, had the following to say in a speech to the Press Gallery at the House of Commons last week. "We can see clearly various practical applications of space research, such as world-wide radio-telephone communication and television, both of which may be commercially most remunerative. They include also the improvement of weather forecasting, the better observation of the stars, military intelligence, cosmic studies of various kinds, and the acquisition of other basic knowledge.

"But these must be regarded only as first thoughts. The potentialities of space research are still largely unknown. It is more than likely that some applications, which we have not yet thought of, will become indispensable for essential purposes, which we have also not yet thought of. The fact that we really have no idea where it might ultimately lead us, may perhaps be the best of all possible arguments for going ahead and finding out."

TITAN II

On June 20 the Denver division of The Martin Company were awarded an $8m development contract for the SM-68B Titan II. This is the first step in an overall improvement programme which is expected to cost no less than $400m. In view of the time-scale of the more attractive solid-propellant SM-80 Minuteman, it is surprising that the USAF should be prepared to spend so much on wringing more out of the earlier—and more expensive—concept.

A drawing published by *Aviation Week* shows that the new Titan will be considerably larger than its predecessors. The first stage is being extended in length from 57ft to 67ft (including motors), and the second stage, although remaining 37ft in length, will in the new missile maintain the full 10ft diameter of the first stage. As a result a new transition piece will be employed beneath the re-entry vehicle. The twin-chamber Aerojet-General LR87 engine of the first stage is being uprated from 300,000 to more than 400,000lb, and the LR91 of the second stage will also have a slight increase in thrust over the 80,000lb (*in vacuo*) of the current unit. A change of considerable significance is that storable propellants (nitrogen tetroxide?) will be employed in Titan II, in order to make the operational missile capable of being launched directly from its silo, with a reaction time of possibly no more than one minute.

Titan II is scheduled to be deployed with SAC squadrons late in 1963. It is not yet known whether any of the Titan I missiles currently in production will be able to take advantage of the entirely new inertial guidance system under development for Titan by AC Sparkplug (Titan's original inertial system was given to the Atlas ICBM in return for the earlier missile's radio-inertial guidance), but the AC system will certainly be employed in all Titan IIs. In conclusion, it seems likely that the principal reason for the continuance of development effort on Titan stems from the fact that the basic missile carries an exceptional payload. Maximum yield of the Minuteman warhead is unlikely to exceed 2MT, whereas the Titan warhead is reputed to vary up to 7MT, which may be demanded for some targets. Even with this payload, Titan II will certainly have a range of at least 9,000 miles.

MORE SOVIET ICBM TESTS

It was reported by the Soviet news agency, Tass, on June 29, that in the new series of Russian test flights of strategic ballistic weapons, scheduled for this month, the target area in the Pacific would be only half the size of that used in the first series of such firings in January. The agency quoted Prof Ari Sternfeld as saying that the new target area will be south-west of the previous one (*Flight*, January 29), farther from the centre of the Marshall Islands and from the shipping routes in that part of the Pacific. It was about 8,125 miles from the western frontier of the Soviet Union to the prescribed area. The reduced size of the announced target was, said Prof Sternfeld, "a pointer to the increased aiming accuracy of Soviet ballistic missiles."

ASROC

In last week's issue we published a photograph of a launching of the Asroc ASW weapon of the US Navy. Further details of this system are now available. It is one of a series of new developments intended to maintain America's vital ability to defend herself against modern submarines.

The basic vehicle is an 11,000lb-thrust solid-propellant boost rocket attached to the rear of a Mk 44 electrically propelled and acoustic homing torpedo (or a depth charge, although this is unusual). The complete assembly, some 15ft in length, is suspended from a rail launcher, the elevation and azimuth of which are automatically guided by the SQD-23 sonar system which determines the location of the target and automatically computes the correct launching angles and range. The latter parameter is controlled by automatically timing the point at which the payload is ejected from the motor. After launching, flight is purely ballistic (although both booster and payload have cruciforms of stabilizing fins), and after separation the payload is decelerated by a 6ft parachute to prevent damage upon entry to the ocean.

Launch weight of the Asroc is of the order of 1,000lb and maximum range appears to be about 4,000yd. A particular advantage claimed for the new system is that the complete detection and launch systems are more closely integrated than in earlier ASW weapons, so that targets can be engaged only a few seconds after detection.

In the tenth attempt to recover an instrumented capsule from orbit, the US Air Force launched Discoverer 12 from Vandenberg AFB on June 29. It was later announced that the satellite did not achieve the desired polar orbit.

It is expected that a Polaris will be launched from USS *George Washington* during the next six weeks, probably along the Atlantic Missile Range. Admiral H. P. Smith, C-in-C US Naval Forces Europe, said last week that each Polaris submarine will have two crews and could remain in touch with shore bases even when submerged.

On June 23 the USAF officially announced their findings into the enquiry into the destruction by fire of a Boeing IM-99A Bomarc and its emplacement at McGuire AFB, New Jersey. Root trouble was the bursting of the high-pressure helium bottle located in the missile fuselage between the two integral tanks and used to pressurize the tanks and force the fuel into the Bomarc's engines. In the resulting fire the missile's nuclear warhead was "destroyed" but it was earlier claimed that radioactive contamination was due not to the warhead but to heating of thorium alloys in the airframe.

The first Thor IRBM flown back from Britain to the USA was successfully lanuched by its RAF Bomber Command crew from Vandenberg AFB on the night of June 22. Originally it had been deployed by a squadron in Driffield, E. Yorks, in the charge of the same crew. It was the fourth RAF launch in the current combat training programme, and the 13th RAF Thor firing. As was described in our March 18 and 25 issues, Thors currently emplaced in Britain will be progressively returned to Vandenberg for practice firings, and replaced by new missiles from Santa Monica.

SERVICE AVIATION

Air Force, Naval and Army Flying News

Vancouver Non-stop

A VICKERS Valiant of RAF Bomber Command, captained by the AOC No 3 Group (AVM M. H. Dwyer), on Tuesday was to be the first V-bomber making the 6,000-mile flight across the Atlantic to the west coast of Canada: it was due to fly non-stop from Marham in Norfolk to Sea Island, Vancouver in a time of approximately 15hr.

The aircraft, from No 214 Sqn, was being air-refuelled over Goose Bay (Labrador) by another Valiant of the same squadron captained by Flt Lt A. W. McDonald. The return flight was also to be made non-stop.

First landing by a Westland Wessex on an aircraft carrier: XM327, with Westland chief test pilot W. H. Sear at the controls, about to touch down on HMS "Hermes" at Portsmouth on June 23

July Promotions

TWO new air marshals are named in the Air Ministry list of half-yearly promotions: they are AVMs A. Earle, Deputy Chief of the Defence Staff; and S. C. Elworthy, recently appointed Commander-in-Chief British Forces Arabian Peninsula. There are also six new air vice-marshals: in the GD Branch, Air Cdres C. Broughton, C. H. Hartley, T. O. Prickett and T. W. Piper; in the Technical Branch, Air Cdre H. B. Wrigley; and in the Medical Branch, Air Cdre S. R. C. Nelson.

AAC Beavers

GOOD news for the Army Air Corps: the order for 36 Canadian D.H. Beavers, forecast on December 17 last year, has now been formalized. Main components of these aircraft will be manufactured at the D.H.C. factory at Downsview, Toronto, and shipped to England. The de Havilland works at Chester will assemble them, installing British equipment (including radio and instruments), and they are to be test-flown and delivered from late this year onwards. Liaison duties and casualty evacuation are to be the main tasks of the Beavers in the Army Air Corps.

Royal Visitor

PRINCESS MARGARET was to review the passing-out parade of No 17 Course at No 2 Air Navigation School, RAF Thorney Island, last Wednesday. Plans were for the Princess to be greeted on her arrival at 11 a.m. by the AOC-in-C Flying Training Command, Air Marshal Sir Hugh Constantine, and the station commander, Gp Capt W. G. Devas; she would then inspect the parade, hand the Queen's commission to successful students, present three trophies won by course members and address the parade. Her Royal Highness was also attending a service of dedication in the parish church and, after lunch, watching a flying display from the lawn of the officers' mess.

Staverton Display

IT would be difficult to say which item was the highlight (writes "R.A.," reporting on the RAFA display at Staverton Airport on June 25), because each was *par excellence* in its own sphere. As in pre-war days, the item which still captures and holds everybody's attention is the parachute descent, and after seeing the magnificent exhibition by Mike Reilly and Tony Millar it was little wonder that they received a tremendous burst of applause. Their first dual descent brought them down perfectly in front of the crowd; later in the day, with a freshening wind, they sailed over the sea of upturned faces to land "behind the lines."

There was an impressive demonstration of asymmetric flying in a Varsity piloted by R. A. Palmer of S. Smith & Sons Aviation Division; "helicopterics" by a Dragonfly from RAF South Cerney, the pilot (dressed in loin cloth and turban) climbing down a rope and putting the aircraft through its paces by the aid of an alleged magic wand; Tiger Moth aerobatics by C. Nepean Bishop, and aerobatics in a Provost, Jet Provosts, Vampire, Hunters and a Meteor by Flt Lt D. J. McCann, a four-man CFS team led by Flt Lt R. Langstaff, Flt Lt R. E. Holloway, No 92 Sqn (Sqn Ldr R. H. B. Dixon) and Fg. Off G. Rorison respectively.

Glider aerobatics were performed by Tony Gaze of Bristol Gliding Club in a Slingsby Eagle, a beautifully judged landing bringing him down at precisely the point where he had been towed off; No 230 OCU, RAF Gaydon, provided a very close view of a Valiant; and a KB-50J tanker of the USAF flew past in contact with a F-101A Voodoo and B-66B Destroyer. Despite a threatening horizon, not a spot of rain fell during the 2¾hr of the display—organized by the Midland Area of the Royal Air Forces Association.

ETPS visitors to the Sperry Gyroscope Co Ltd at Brentford being briefed on a blind flying panel by a Sperry Aeronautical School instructor, Mr S. Jennings. Listening are (right to left) Capt K. R. Hickson, RN, the Commandant; Lt-Cdr W. D. Lang, RN, an ETPS tutor; Maj W. A. Cato, USAF; and Lt E. J. Hogan, USN

IN BRIEF

The Duke of Edinburgh has consented to become president of the Guinea Pig Club in succession to the late Sir Archibald McIndoe, who died in April.

Marshal of the RAF Sir Dermot Boyle is to present a standard to No 17 Sqn, with which he flew nearly thirty years ago on his first squadron posting, at RAF Wildenrath in Germany next Tuesday (July 12). The unit now operates Canberra PR.7s on photographic reconnaissance duties.

AVM H. B. Wrigley, until recently at the MoA and before that (from June 1954) director of signals (1) at Air Ministry, has been appointed Senior Technical Staff Officer at RAF Fighter Command headquarters.

Air Cdre M. K. D. Porter, who joined the RAF in 1928 as an aircraft apprentice, has been appointed Commandant of No 4 School of Technical Training at RAF St Athan.

Gp Capt W. N. Hibbert, Deputy Director of Financial Services at RAF Germany headquarters since 1958, has become Director of Personal Services (B) at Air Ministry with the acting rank of air commodore.

Servicing of Avro Shackletons of Coastal Command—described by Air Ministry as "modernization and replacement" work—is being undertaken from August onwards by the de Havilland factory at Broughton near Chester.

The RAF is looking for 600 boys to start training as apprentices next year. Full details may be obtained from AM pamphlet 339, obtainable from the Central Recruiting Office, Air Ministry, London WC1, or from any RAF recruiting centre.

No 211 (Newbury) Sqn of the ATC has a wooden propeller which is believed to have belonged to the Bristol "Long Prier" monoplane supplied to the War Office for evaluation purposes in 1912. Its story is told in the June issue of *ATC News* by the squadron adjutant, Fg Off B. A. Philpot.

Last Monday the Handley Page Herald brought Sr Frondizi, President of the Argentine, from Holland to Gatwick Airport. He was greeted by the Hon George Ward, Secretary of State for Air, and an RAF guard of honour. The new dorsal scoop on the Herald's fin is brought into operation for cooling the cabin at low altitude; it is incorporated on all production aircraft

AIR COMMERCE

RIDDLE WILL HAVE THE ARGOSY

RIDDLE'S order for five AW.650 Argosies is now firm. The airline is to participate in the "Logair" cargo service operated by MATS for the Air Materiel command of the USAF. The award of the three-year contract (total revenue from which should amount to between $20m and $25m) finally clinches the order, originally for three aircraft plus two on option, which the airline and Sir W. G. Armstrong Whitworth Aircraft have been negotiating since early last year. The Logair contract specified straight-in loading from truck-bed height of 15,000lb loads—a condition which could be met on the specified routes only by the Argosy.

Riddle was to have started the Logair operation at the beginning of July with ten C-46s. As from the last quarter of 1960 it will replace these with Argosies at the rate of one AW.650 for two C-46s. Operation of the three daily patterns which the contract requires will give Riddle a guaranteed daily schedule of 12,600 miles on which they will carry outsize cargo including aircraft engines and missile components: parts, they say, which are not now conveniently accommodated by modified passenger-type commercial aircraft.

In confirming the order, AWA say that a deposit is being paid by Riddle and negotiations are now going ahead on configuration, loading systems, spares provisioning and other matters. The aircraft will bear Logair markings, and Riddle are to start Argosy operations "early next year."

According to Robert M. Hewitt, the airline's president, the price being paid is about $9m with spares.

TUPOLEV TELLS OF THE 124

ACCORDING to *Pravda*, which published an interview with Andrei Tupolev recently, the Tu-124 will have only 44 seats—20 of first-class standard and 20 of a removable variety and apparently less comfortable. The Tu-124 is the first Russian air transport to have turbofans (designed by Soloviev); and it was described by Mr Tupolev as being a fast, medium-range transport with a wide variety of uses—including operation from short airfields. Maximum speed is said to be 620 m.p.h. and cruising speed "greater than that of the Tu-104"; in other words, in excess of 500 m.p.h. [Picture, page 33.]

A PAGE IN *THE TIMES*

THE advertising manager of *The Times* must have regarded the issue for Friday, July 1, with considerable satisfaction. In it the Air Transport Advisory Council filled more than a whole page of the classified Public Notices section with applications for new services.

It could be that readers of *The Times* will never again see airline business taking up so much space in one issue; for last Friday's notices anticipate the ATAC's last big job before it gives way to the Air Transport Licensing Board. The task is to consider applications for every series of more than three non-scheduled flights in the summer of 1961.

Although nearly 800 separate applications have come forward compared with last year's figure of about 600, this does not necessarily represent a 33⅓ per cent rise in the volume of expected business. This year's applications include, for the first time, "closed-group" services, which now have to be licensed like inclusive tours. Most of the better-known closed-groups appear in the list: the Overseas Visitors Club, Whitehall Travel, the Royal Automobile Club, a number of Catholic organizations—to cite a few. If allowance is made for the closed-group applicants, the number of applications for inclusive tours appears to be about the same as in the current year.

In three ways the pattern of applications for 1961 departs radically from that of yesteryear. In the first place, large numbers of applications have been put forward by a group of travel agents working together rather than singly. Secondly, agents no longer appear to be so closely wedded to individual airlines; most are now proposing to do business with more than one airline next summer. And finally, a remarkably high proportion—something of the order of 75 per cent—of applications has been put forward by non-BIATA independents. Overseas Aviation and Tradair emerge as the most ambitious applicants, followed by two of the smaller independents (Continental and Air Safari) and a newcomer, Maitland Drewery Aviation (who have recently acquired a fleet of Viscount 700s from Air France). At the other end of the spectrum, such large-scale past and present IT operators as Eagle and BKS are found to have put in only about a score and half-a-dozen applications respectively. Perhaps the moral here is that the adventurous IT game is something that appeals less to the mature adult than to the growing youngster.

PIPE IT ABOARD

OFFICIALLY opened last Monday by Sir Gerard d'Erlanger, chairman of BOAC, was the Shell-Mex and BP pipeline along which fuel is supplied to London Airport from the depot at Walton-on-Thames; it is the first into any British airport.

In practice two 6in pipes run parallel under 17 roads, two railways, the Thames and Kempton Park racecourse before surfacing on the west side of London Airport. The pipes were installed and ready before BOAC's 707 services on May 27. Supply of fuel in the normal way by road tanker will continue; last year 45 million gallons were supplied to London Airport by Shell-Mex and BP in this way.

CAN CUBANA'S BRITANNIAS DO IT?

NEWSPAPER reports last week stated that the oil companies, as a reprisal for the seizure of US oil interests in Cuba, are refusing to refuel Cubana, who are having to tank up in Havana with sufficient fuel for return trips to the US and Mexico.

The New York and Mexico operations would be possible with Cubana's Britannia 318s. To New York (1,150 n.m.) the limit would be the maximum landing weight of 137,000lb; if the aircraft landed there at this weight, with sufficient fuel for a return long-range cruise and allowances for ground manœuvres, passenger load factor would be limited on the north-bound leg to 65 to 70 per cent of the capacity of 94 seats. There would be no payload restrictions southbound. However, if an aircraft were too long in the New York holding pattern, it might be stranded at New York. This possibility could perhaps be ameliorated by over-fuelling in Havana and burning off excess before landing at 137,000lb.

The Mexico route would appear to be easier: if arrivals were scheduled to avoid the hottest time of the day, and hence WAT limitations on landing weight, an 80-90 per cent passenger load factor would be possible westbound, and full payload eastbound.

MR GERALD WYNNE

IT is with regret that *Flight* records the sudden death, on June 27, of Mr Gerald Alister Wynn-Wynne, director of public relations for BOAC in North America, at the age of 56. He died on board his launch at Essex, Connecticut, as the result of a heart attack.

Gerry Wynne had been with BOAC for 15 years, and his loss will be keenly felt by the corporation. His knowledge of America and its Press was probably unsurpassed by that of any other Englishman. Born in London, he lived most of his adult life in America, his first assignment—at the age of 19—being a junior Harlem reporter on a New York newspaper, which was probably one of the toughest introductions to journalism that could be imagined.

Notwithstanding the depth of his roots in America, where he was at various times with Reuter, Hearst Features, the Hearst Features Syndicate and *The New York Times*, Gerry Wynne always remained unaffectedly English.

AIR COMMERCE . . .

Photographed at the signing of BOAC's contract for ten Vickers Super VC10s at London Airport on June 23 were, left to right: Mr N. H. Jackson, director, Vickers (Aviation); Sir George Edwards, executive director, aircraft, British Aircraft Corporation; Mr K. H. Staple, secretary and legal adviser, BOAC; and Mr Charles Abell, chief engineer, BOAC. The order was reported in last week's "Flight"

MR SANDYS HAS AN ANSWER

THE Minister of Aviation, Mr Duncan Sandys, was last week tackled in the House of Commons about congestion in the terminal buildings at London Airport North and was asked what was being done to improve its facilities. The Minister was also asked about the possibility of work on the new long-haul building being expedited.

In reply, Mr Sandys said that some exceptional delays in handling incoming passengers had occurred on June 20 as a result of the arrival of an abnormal number of large transatlantic airliners within a short space of time. This was due partly to "unavoidable delays in departures from New York, which also has its own problems of traffic congestion." The position was further aggravated by unscheduled charter flights. He went on:—

"Fortunately the peak period for the arrival of long-distance passengers at the north station coincides with a comparatively slack period for the arrival of Continental passengers at the central station. I have therefore given instructions that when the arrival of delayed or non-scheduled flights appear likely to cause congestion at the north station, the aircraft concerned will be handled instead at the central station.

"Meanwhile, we are pressing ahead with the construction of the new long-distance air station, half of which will be ready for occupation next year."

HELIPORT FOR NINE ELMS

AFTER nine months' deliberation, the Joint Interdepartmental London Helicopter Committee, on which were represented the Ministry of Aviation, the Ministry of Housing and Local Government, the London County Council, the British Transport Commission and BEA, last month reported on the proposal to build a new London heliport on the Thames at Nine Elms, Battersea, or at two alternative sites.

The report of the Committee has been completed and submitted to Mr Duncan Sandys, Minister of Aviation, whose sanction is required before planning permission can be given. The new heliport, which would be operated by Rotorports, would be constructed not far from Westland's present site at Battersea, but the platform would be considerably larger. BEA will be one of the major operators at the new heliport, which has been intended since its inception to accommodate the Rotodyne.

The Ministry of Aviation's predecessor, the MTCA, had given technical approval to Rotorports' plan early last year and the implicit approval of the planning authorities was given following an inquiry in London at the end of April 1959. The London County Council then withdrew earlier objections that they had had to the scheme, but said that they were unable to accept responsibility for approving the project. That responsibility falls on Mr Sandys; and after many months delay it seems likely that a firm decision can now be expected shortly.

BLACKBURN'S CARGOCOPTER

BLACKBURN AIRCRAFT have been studying a combined vertical-jet, rotating-wing cargo tug project known as the SP 60. A brochure outlining their ideas has been circulated to the Services and to airlines, but when the project was revealed—three years after the investigation was initiated—further work had apparently already ceased. Blackburn say merely that it was a design investigation by their projects team and that cessation of work was not necessarily connected with their amalgamation into the Hawker Siddeley group. The latter add that they are "very interested" in the study but that there are no plans for production at present.

But there is no doubt that the separate prime mover concept interests the Channel Air Bridge for its potential as a car, freight and passenger transporter. It seems obvious that this airline cannot have been overlooked by those responsible for the SP 60 design. Some details about the vehicle-ferry operator's thinking are given on page 40. Silver City, on the other hand, say that they have not been approached.

The SP 60 is a vertical-lift power unit that could be coupled to pre-loaded nacelle units of light and inexpensive construction. A transportable passenger unit, it is reported, might cost £50,000 and accommodate 250 passengers, or a car-ferry version 90 passengers and 18 cars. Ideas for the design of the latter may well have been advanced by Channel Air Bridge. It is clearly feasible to couple the prime mover to nacelles that are designed specifically to perform one task. A pallet could be used for heavy freight for example, a box-car for lighter cargo, and a special vehicle as a combined car and passenger unit, and so on.

The Blackburn prime mover consists of a six-bladed, 100ft diameter rotor and six vertically mounted lifting engines. The combined unit would have a forward speed of 170 m.p.h. and a loaded range of 100-350 miles. Range with maximum fuel but no payload is reported to be about 1,000 miles. An estimate of the cost of the tug is given as £400,000 in quantity production. There is presumably no reason why such a device should not be employed as a crane on construction work or as an ultra-short range transport whilst it was under-utilized in an airline's winter season.

CONSTANT-LEVEL AIRWAYS

LAST Friday, July 1, saw the start of a new experiment designed to make life easier for pilots and air traffic controllers in the Europe-Mediterranean (Eumed) region. Hitherto, when flying under IFR on airways, it has been necessary to conform to the quadrantal height rule. This has necessitated changing cruising level whenever a bend in an airway took it from one side to another of a quadrantal point.

The ICAO Eumed RAC/COM meeting held in February of this year recognized the inconvenience and possible dangers of this system and proposed that for a trial period of six months set cruising levels should be allotted to each airway and that these should hold good throughout the entire length of the airway within the Eumed region. Thus Amber 6, extending from Amsterdam to Marseilles and which swings from 202° through 193°, 172°, 148°, 190° to 181°, previously required three different cruising levels. Now it will only require one.

HUREL DUBOIS HD.130

A PROSPECTUS recently issued by Hurel Dubois in France gives some details of a new light transport project designated HD.130 and first mentioned in *Flight* for June 17.

It is not stated whether this aircraft is to have the high-aspect ratio wing characteristic of earlier Hurel Dubois designs, but the powerplant will be two Turboméca Astazou turboprops giving 500 h.p. each and capacity will be for 14 passengers or one vehicle or 4,900lb of freight for 125 miles or 3,250lb for 935 miles.

The aircraft will be specially designed to use short, rough fields, will weigh 12,300lb loaded and cruise at 187 m.p.h.

LORD TERRINGTON'S APPOINTMENT

A MAN who, says the Minister of Aviation, "commands widespread confidence" has been appointed chairman of the new Air Transport Licensing Board. This description of Lord Terrington is one with which everyone in British air transport, and especially those who have argued their case before him on the Air Transport Advisory Council, would concur.

Lord Terrington has been chairman of the ATAC since its inception in 1947, and the hundreds of meetings, some of them very difficult ones, that he has chaired over the years have always taken place in an atmosphere of good humour and minimum formality. Though himself a lawyer, he holds little brief for those who conduct their case in too legalistic a manner—which perhaps augurs well for the future of the new ATLB.

The Air Transport Licensing Board will probably not be fully in operation before the end of 1960, and for a time the ATAC will function in parallel with it. Lord Terrington's appointment will ensure the necessary continuity and also what the Minister describes as "a smooth transition from one to the other." Mr Sandys says that he will announce the names of the other members of the Air Transport Licensing Board "in due course."

EXIT TOURIST CLASS

LAST Friday, July 1, saw the end of tourist-class services on the North Atlantic. Introduced on April 1, 1952, tourist class has been completely replaced—after eight years and three months—by economy class.

A brief IATA "obituary" records that approximately 3,017,000 passengers flew tourist class across the North Atlantic, and that tourists represented 43 per cent of total passenger business on this route during the 99 months of its existence.

During the first full year of tourist-class fares, which were 31.6 per cent below the existing first class, total traffic increased 31 per cent. By 1953 tourist accounted for 63.3 per cent of all transatlantic scheduled passenger traffic and this share rose rapidly each succeeding year—69.1 per cent in 1954, 70.9 per cent in 1955, 73.4 per cent in 1956, and 76.4 per cent in 1957.

Already economy class accounts for about this proportion of North Atlantic business (actually 74 per cent in 1959), and the complicated and difficult-to-sell three-tier fare structure is now replaced by the basic first-class and economy-class two-fare structure.

It was tourist class which, having been pioneered on the North Atlantic, to stimulate a stagnating traffic growth-rate, stimulated the trend towards lower fares throughout the world; and of course it still exists on most other international routes. But it seems doomed to be progressively ousted by economy class—as it now has been on the Atlantic, and as is happening on the routes between Europe and South Africa.

BEA AND THE WRIT

HAVING already paid out more than £150,000 in personal claims arising from the Munich air disaster, BEA has now received a writ from Manchester United Football Club claiming a further £250,000 compensation. Manchester United's claim is said to be based on the potential transfer-fee value of the players who were killed, loss of prestige, and loss of gate money.

A BEA spokesman says that the corporation intends to defend the case. The legal considerations involved are likely to prove complex, though the law itself is straightforward enough in respect of an airline's liability in the event of an accident.

As is well known, BEA Elizabethan G-ALZU commanded by Capt James Thain crashed on take-off at Munich on February 6, 1958. Among the 23 people killed were eight players and three club officials.

The Warsaw Convention of October 12, 1929, imposes on an air carrier *prima facie*, but limited, liability for death or injury to passengers. This convention was aimed at unifying the many different national laws relating to the liability of carriers, and it was given effect in English law by the Carriage by Air Act, 1932. The limit of liability is 125,000 gold francs (£3,000) per passenger, and a carrier is liable to pay this sum—for which it is invariably insured—*unless* it can prove that the accident was not its fault. The Hague Protocol of 1955, which among other things increased the limit of liability from £3,000 to £6,000, is not yet ratified by the 30 States required for it to be effective.

Liability is unlimited only if a claimant can prove *wilful misconduct*. If he can do so, the sky is the limit on his claim. The revelant section of the Carriage by Air Act is Article 25, which reads:—

"(1) The carrier shall not be entitled to avail himself of the provisions of this convention which exclude or limit his liability, if the damage is caused by *his wilful misconduct* (our italics) or by such default on his part as, in accordance with the law of the Court seised of the case, is considered to be equivalent to wilful misconduct.

"(2) Similarly the carrier shall not be entitled to avail himself of the said provisions, if the damage is caused as aforesaid by any agent of the carrier acting within the scope of his employment."

The point about a claim for damages higher than the limit set by the Warsaw Convention is that the claimant has to prove the carrier or his employees to have been guilty of wilful misconduct.

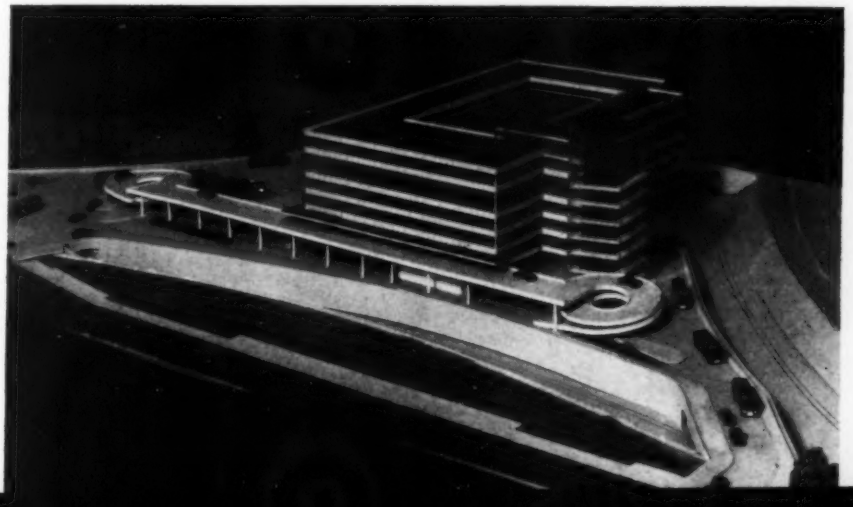
1960 HALF-YEAR ACCIDENT RECORD

DURING the first six months of 1960 there were 23 accidents involving civil transport aircraft, causing the loss of 590 lives. Of these more than 480 were passengers and more than 80 were crew (see footnote to table for explanatory qualification). The record is shown in the following table, a *Flight* compilation.

The tabulation is provisional, and it includes non-scheduled as well as scheduled flights. It is not known in all cases which were scheduled flights, so it is possible to draw only tentative conclusions as to the scheduled airlines' safety record so far this year. It will be noted that nearly half the accidents were in Latin America.

Date	Carrier	Aircraft	Location	Fatalities Pass.	Crew	Circumstance
Jan 6	National	DC-6B	Bolivia, S. Carolina	29	5	Sabotage
Jan 18	Capital	Viscount	Holdcroft, Virginia	46	4	Mechanical failure?
Jan 19	SAS	Caravelle	Ankara	35	7	Hit hill on approach
Jan 21	Avianca	Super Constellation	Montego Bay	37*	?	Heavy landing
Jan 27	Transportes Aereos de Timor	Heron	Timor Sea	7	2	Unknown
Feb 5	Lloyd Aero Boliviano	DC-4	Cochabamba	55	4	Take-off
Feb 25	REAL	DC-3	Rio de Janeiro	30*	?	Mid-air collision with US Navy DC-6
Feb 26	Alitalia	DC-7C	Shannon	19	11	Take-off
Mar 16	All Nippon Airways	DC-3	Komaki Airport, Nagoya	2	1	Collision with jet on landing
Mar 17	Northwest	Electra	Tell City, Indiana	57	6	Mid-air disintegration
Mar 20	Sociedad Aeronautic Medellin	C-46	Medellin	25	3	Forced landing with engine trouble
Mar 20	Colombian Aido Canso	Amphibian PBY-5A	Eastern Colombia	4	2	Crash landing
Apr 5	Lineas Aereas de Nicaragua	C-46	La Luz Mine Airport	3	1	Unknown
Apr 12	Varig	DC-3	Location uncertain	5*		Burst tyre on landing
Apr 20	Lloyd Aero Colombiano	C-46	Bogota	31*		Crashed on approach
Apr 22	Sobelair	DC-4	Mt Bogora, Congo	28	7	Flew into mountain
Apr 28	Linea Aeropostal Venezolana	DC-3	Calabozo Airport	8	2	Sabotage
May 3	Navegacao Aerea Brasileira	C-46	Ramey AFB, Puerto Rico	5*		Forced landing with engine trouble
May 15	Balair	DC-4	Jebel Marra Mt, Sudan	2	10	Believed hit mountain
May 19	Air Algerie	Caravelle	Paris Orly	1	—	Mid-air collision
Jun 10	TAA	Friendship	Mackay, Queensland	25	4	Unknown
Jun 15	Pacific Northern	Constellation	Mt Gannett, Alaska	9	5	Crashed into mountain
Jun 25	REAL	Convair 340/440	Rio de Janeiro	48	5	Following diversion

* Includes crew.



BEA have decided to develop their West London air terminal and to construct a permanent building, a model of which is depicted here. It is scheduled for completion in 1963, and will cost £3½ million. When fully developed it will be capable of handling up to seven million passengers a year. Meanwhile BOAC have been extensively re-commissioning and re-styling the interior of their London terminal at Victoria

AIR COMMERCE . . .

THE OTHER SIDE OF THE BRIDGE

THE only airline to retain its identity in the amalgamations which have led to the formation of British United Airways is the Channel Air Bridge—now Channel Air Bridge Ltd. The implications of the special nature, and promising future, of the cars-across-the-Channel business are re-examined here in the light of the recent revelation of the Blackburn SP 60 cargo tug, a type of vehicle in which the Air Bridge has displayed more than a passing interest.

WHAT will the new Channel Air Bridge look like five or six years from now? What, in fact, will be the pattern of Continental car, passenger and freight travel during the middle years of the 1960s, when the enterprise that Air Charter began in 1954 is twice as old as it is today? Major political upheavals aside, expansion of air ferry traffic to the Continent should continue more or less at the same rate as it has done over the past five years; the great change in the pattern seems likely to be a minor diminution of importance of the Channel airports relative to those of the deeper penetration routes many miles further inland. With more cars, more time off and more Continental holidays, distance still lends enchantment to the more far-flung holiday destinations. Time and trouble-saving in satisfying this trend to travel further afield is the *raison d'être* of the deeper penetration routes, one of the more urgent reasons for construction of the ATL-98 car ferry conversion, and for the examination of advanced new projects.

Applications have been made by Channel Air Bridge for routes to Paris, Dijon, Lyons, Strasbourg, Tours, Dusseldorf and Bremen. Although not all are likely to be granted (Paris in particular is hotly contested by Silver City, who also dispute Strasbourg because of their DC-3 service to Basle) these points give access for journeys deep into the Continent of Europe and Scandinavia. A year or two ago they would have made commercial nonsense; now it seems that there are sufficient experienced cars-by-air travellers who are prepared to meet the much greater expense of taking a car further afield—and what motorist is going to hire another car if he can possibly take his own? But until the ATL-98 comes along (first nose was to be sawn off a DC-4 earlier this month) present services to Calais, Ostend and Rotterdam continue to provide the expansion of traffic that will make the long-haul routes possible. The alternative entries into Continental Europe were selected from a passenger survey made with a reminder that for extra distances higher fares must be charged, nevertheless 3,000 letters of application for travel on these as yet non-existent routes were received during the past year.

So the future of the Air Bridge is closely associated with the longer-haul routes from Southend deeper into the Continent. There is also a possibility that as 90 per cent of all passenger and accompanied-car traffic originates in the United Kingdom, one day the Bridge will be extended to inland Britain; perhaps to the North Country or to Scotland. In any event the policy of the company is to link up as far as possible with railway services and, as previously recorded, the Southend local authority have under consideration a combined airport terminal building and railway station modelled on that of its Gatwick neighbour.

The new air bridge vehicle—the ATL-98—also provides the first real opportunity of alleviating the intense seasonal problem which has always beset the car ferry operators. The answer to this, it has always been appreciated, is to find work elsewhere during the British winter, and the possibility is being studied of using an ATL-98 on inter-island vehicle ferry services and on similar services in North America: one might be the carriage of cars across the Great Lakes. None of these is feasible with the Bristol 170, which has capacity for only two American-sized cars.

Possibly one of the less obvious ways in which new equipment should benefit the Air Bridge is by transforming the whole operation into something considerably more up to date than it ever could be with the present equipment. Affectionately regarded as the Bristol Freighters are (and they still have a useful short-haul life ahead of them), the whole standard of service should be improved when the larger aircraft is introduced. What the airline's management would like to see on all services is a much lower noise level in the aircraft, a better standard of comfort and the provision of toilets. There is sufficient weight to spare in the ATL-98 to make the interior quite plush and quiet and the Air Bridge naturally hope to gain ground on their Air Ferry rivals at least until the time that Silver City's new equipment comes along.

One difficulty of this type of operation that the deeper-penetration routes can alleviate only to a limited extent is that of low utilization; after great efforts it is still only about 1,400hr a year. If the solution does not lie with new routes, it may be found with new vehicles—not necessarily aircraft. Attractive at first sight, a practical hovercraft has many of the limitations of a surface cross-Channel vessel; its usefulness is restricted by the time taken to load and unload its cargo. The ideal vehicle hovercraft might be one that carried 100 cars across the Channel at 100kt, but Douglas Whybrow, a director of Channel Air Bridge, is inclined to believe that an air-cushion vehicle with favourable operating economics would have to carry more than 100 cars. Nor, for practical and administrative reasons, would there be much possibility of using anything but expensive fixed installations as terminal points.

Another full-load departure from Southend. This year the number of cars carried should rise from 18,400 to about 25,000, supplementary passengers from 42,000 to 72,000

Much more attractive to the Air Bridge in the long term is the VTOL prime mover idea (possibly as exemplified by the Blackburn SP 60 project). Its function would be to lift nacelles containing payload to the various destinations on the company's routes and it would touch down only to refuel and when change of crews was required. In Air Bridge service its turn-round time would be merely that taken to off-load one nacelle and pick up the next—already pre-loaded with passengers, cars or freight. The variety of tasks that such a machine could perform should allow a high utilization because the usefulness of such a vehicle would not be confined to the car ferry operation. A planned lifting capacity of 18 cars or 90 passengers should in addition allow a very useful inter-city European freight service to be developed and for the first time it would also enable large commercial vehicles and motor coaches to be airlifted across the Channel.

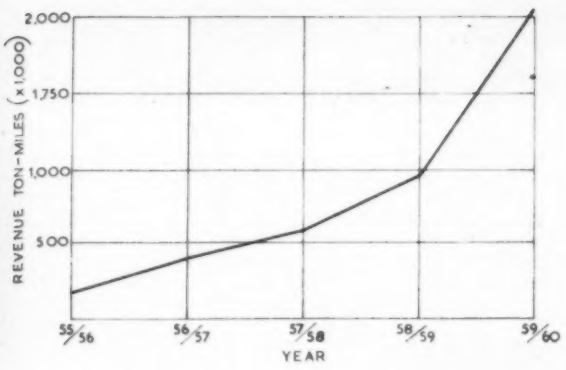
Although these are long-term ideas they are being seriously considered by the Air Bridge for the time when usefulness of the Bristol Freighter is drawing to an end. It is not the Blackburn project *per se* that appeals to the Air Bridge so much as the concept of employing in air transport a separate prime mover; they argue that what is so obviously logical in other fields of transport (tugs and barges, commercial prime movers and trailers) has an obvious application in the air. The really expensive part of the transport system—the prime mover itself—ought to be divorced from the payload so that it can continue to work unhampered by operations on what is essentially a container for passengers or freight. Liberating the container from the prime mover ought to allow much greater freedom in its conception, design being directed, as the Air Bridge sees it, for operation at maximum utilization—to the extent of the prime mover being able to continue to lift a reduced payload even with one or two engines inoperative.

	Calais	Ostend	Rotterdam
1955	532	15*	—
1956	608	209	33*
1957	1,033	339	341
1958	1,108	717	848
1959	1,510	1,019	1,041

*Three months only

How the Air Bridge's revenue ton miles are going—a "from the beginning" across-the-Channel howgozit

The table shows how traffic has expanded at each of the three Continental airports since the Air Bridge service began; it provides the justification for imaginative planning for half a decade ahead. All three terminals have plans for expansion to cope with increasing numbers of services during the months of peak summer traffic. At Calais approval has been given for an expansion of the



The beginning of October to the end of May are the traditional lean months of the car ferry business, but the rising slope of the curve indicates recent big improvements in winter traffic

hard standing to cope with additional arrivals and departures. A similar extension for up to 20 aircraft is being made at Ostend and the terminal buildings are being extended and re-organized to include a car handling unit similar to that at Southend and Calais. It will handle about 10,000 cars in the first year. The new airport at Rotterdam has expanded considerably since the opening ceremony 2½ years ago and here again expansion plans are already in hand. Air traffic via Holland provides fewer cars and passengers for the Air Bridge than into France and Belgium but the route produces a considerable quantity of freight—5,000 tons last year.

The importance of the three Continental airports will not diminish when deeper penetration routes are well established because branches of the Continental first-class road system are being extended to the Channel airports. The three between them are handling vehicle traffic that over the past year has expanded by some 38.5 per cent, vehicle passenger traffic at 46 per cent and freight at 63 per cent. Supplementary passengers have increased by 71 per cent. But the high frequency that is made possible by selling the carriage of these commodities is offered equally to each. The operation of longer routes should continuously narrow the gap in fares betwen surface and air on short hauls.

Within the last two years, the Air Bridge claims to have swung over from an annual loss to a small yearly profit.

An adventurous future appears to lie ahead for the younger of the two British car-cargo operators. It is this, and the special nature of their task, that has established them as an autonomous company within the new British airline.

A. T. P.

BREVITIES

More Caravelle repeat-orders are announced: Air France have increased their order from 24 to 27; Alitalia from 4 to 8; and Air Algérie from 4 to 6. To date 91 Caravelles have been ordered by ten operators.

The Vertol 107 is being offered to NZNAC as a DC-3 replacement for the airline's secondary routes. It has been estimated by Vertol that the 107s would cost less to operate than the Avro 748, Friendship, Dart Herald or other DC-3 replacements, offering 25-28 seats (about the maximum required) at a cost of about 15s per n.m.

It is reported that the Convair 60 short-range jet project could be flown in the autumn of 1961. Some new details are available: fuselage (basically 880) is shortened to 112ft 7in; gross weight, 145,500lb; max landing weight, 140,000lb; fuel tankage, 44,000lb (5,430 Imp gal); max seating, 95.

The Colombian airline Avianca announces the purchase of two Boeing 720Bs (JT3D turbofans) for delivery in the autumn of 1961. They will be used on the Bogota - Jamaica - New York run. In the meantime leased jets, presumably 707s, will operate between Colombia and Europe and on the Colombia - Ecuador - Peru route.

The shareholding in British United, which officially came into operation on July 1 (see *Flight* last week) is as follows: Blue Star, 20 per cent; Furness Withy, 20 per cent; Clan Line, 16 per cent; British and Commonwealth, 16 per cent; Hunting, 8 per cent; Mr T. L. E. B. Guinness, 10 per cent; Whitehall Securities, 10 per cent.

The FAA have given American Airlines and TWA a 200hr overhaul-life extension to 1,200hr for the JT3C engines of their Boeing 707s. This is the first time a US commercial jet engine has exceeded the 1,000hr overhaul standard. American have just overhauled their 200th JT3C. Meanwhile the FAA have authorized a 1,000hr life for TWA's JT4s.

Shannon's new runway 06/24 (10,000ft × 150ft) was opened for restricted use on July 3.

Capital have been allowed until July 11 to answer the Vickers suit for repayment of $33,800,000 Viscount debts. This is the fourth extension.

The latest Aircraft Exchange Market Report includes an offer to sell a DC-3 cargo-passenger model for $37,000 (£13,200). For the first time the Canadair CL-44D appears in the Report: it is quoted at a price of $3.8m.

Stockholm's new airport at Arlanda received its first scheduled flight on June 23 when an SAS DC-8 from New York landed on the 11,000ft runway. Since the airport was first used on December 14—when an SAS Caravelle landed there—it has been used by SAS for jet crew training.

Aeroflot demonstrated an Ilyushin Il-18 and a Mil Mi-4 to Norwegian Air Force officers and civil aviation representatives at Oslo Airport (Fornebu) on June 25, according to Moscow Radio. The broadcast added that Aeroflot would soon be starting a sales tour in other West European countries.

Air-India's technical director, A. C. Gazdar, says that his airline is "very interested" in the VC10, which "seems to suit Air-India's route pattern." A team would be sent to the UK to evaluate the aircraft before the end of 1960. "We are particularly concerned with delivery dates," says Mr Gazdar, who adds that Air-India is also studying American aircraft as well as other British types.

Six of TWA's fleet of 29 L.1649A Jetstreams are to be converted into transatlantic freighters. Principal modification will be the embodiment of 106.5in by 74in cargo door opening upwards, a 56.5in by 72in forward cargo entrance and a strengthened floor. The first aircraft should enter service about August 15. Total cost of the programme will be about $1.5 million.

As we go to press Vickers announce that Vanguard flight tests, suspended since May 23 because of a fault in the Rolls-Royce Tyne, is now airborne again. It is expected that engines for both BEA and TCA will be delivered from mid-September, and hoped that certificated aircraft will be delivered "before the end of the year." Original first delivery dates were June for BEA and August for TCA.

Briefcases for "outstanding service in providing weather reports" were awarded last week by the Guild of Air Pilots and Air Navigators to two BOAC captains, G. P. Lace (left) and D. F. Redrup. Making the presentation is B. C. V. Oddie, deputy director of outstations at the Meteorological Office, Master of the Guild, Dr. K. G. Bergin, looks on

Straight and Level

HUNDREDS of letters have been pouring into my office asking why Straight and Level's chief fashion adviser. Hamish Haute-Mode, has had nothing whatever to say about the new BEA stewardess's uniforms.

I am sorry to have to tell you that Hamish had a very nasty turn a few moments after seeing the photographs of the new outfits, and he has been speechless with shock ever since.

● I am sincerely delighted to be able to tell you that my plea to the Ministry of Aviation "to create a friendlier impression" at London Airport did not pass unheeded. On June 24 the Ministry posted the following notices, together with photographs of the model of the new long-haul terminal, in the arrival and departure halls:—

"The airport's management hopes that, until this new and modern passenger building is ready for occupation in 1961-62, you will appreciate that it is not possible for us to offer you, in these temporary buildings, the standard of comfort and efficiency we would wish.

"While staff will do everything possible to help, there are bound to be occasions when you may be subjected to irritating delays and inconvenience. For any such shortcoming we apologize. If you feel that we can improve our service in any way, will you please let us know?"

That's more like it.

● Pseudo-technical people use the most technically "in" jargon they possibly can, just to impress. For example, a pseudo-technical person would say: "Aerodynamic kinetic heating of light-alloy structures at Mach numbers above 2.0 to 2.5 seriously diminishes the strength and aeroelastic properties of the structure . . ."

The true technician will always talk as non-technically as possible. For example, Sir George Edwards' rendering of the above, as recently quoted, was: "If you go faster than 2.2 with light alloy the thing melts . . ."

● Asked in the Commons to say when Blue Steel will be in service, the Minister of Aviation replied: "The hon Gentleman . . . knows that it would be quite improper for me to give any dates of when new weapons are to come into service. It is a very good rule to leave foreign intelligence services to do their own work."

A pretty crushing answer. But it was a perfectly proper question. Why should the British public not be allowed to judge whether its defences are likely to be properly equipped at the right time?

There isn't a single US weapon whose scheduled in-service date has not been openly publicized—and in the majority of instances technical specifications and costs have been published too.

Ministers spend a lot of time worshipping at the altar of the god of Security, a god whom they themselves have fashioned. A very useful god, too, when Members of Parliament start asking awkward questions.

Now don't give me that again, Mossie.
Now don't give me that again, H.P.
There's nothing I enjoy more than a good
There's nothing I enjoy more than a good
argument with an old friend like you,
argument with an old friend like you,
BUT REALLY . . .
BUT REALLY . . .

● Ballistic-missile technical problem for you:—

An American ICBM rocket is fired at Moscow from Cape Canaveral. At precisely the same instant, a Soviet ICBM rocket is fired from Moscow at Cape Canaveral. Where do they meet? Answer below.

● A-buzz with gossip as always, the Air Power Club grapevine has it that sales of the new SRS Secrecy Revealer System—latest product of Thinx Electronics Ltd—have surprised even the makers. So far 1,329 sets have been delivered. Most of these have been ordered by Members of Parliament, airline pilots, air correspondents, and members of the public.

I asked Sir Harold Digit-Smith, chainsmoking gadget-fiend chairman of Thinx, what people were buying SRS sets for.

"The secrecy market is tremendous," he said, lighting three cigarettes with his wrist watch. "Just about everything in British aviation is secret. We get London Airport residents wanting to know about the jet noise tests that the Ministry say they've carried out. We get literally hundreds of people wanting details of airline pool agreements. We had an air correspondent last week wanting the prices that BOAC and BEA have been getting for their used aircraft. Another chap, a pilot I think he was, wanted to know about all the accident reports that have never been published by the Ministry. And we're expecting to sell an SRS to a man who wants to find out how much traffic the independent airlines carry. Oh yes, and we've sold a couple of dozen to MPs who feel they have the right to know how much the UK is spending on Sky Bolt. And so on and so forth. It's a big market, old boy."

* * *

I agreed with him, and asked about price and delivery date of SRS. "Well, unlike other sections of British aviation, we don't claim any special privileges," he said, lighting up three more cigarettes with his cuff-links. "But I'm afraid that's not for publication."

"You mean it's a secret?" I asked.

"A secret? Steady on, old chap—that's a dirty word. No, of course it's not a secret. We've got nothing to hide. It's just—well, it's just not for publication, that's all."

● Is Sir Matthew Slattery's appointment as chairman of BOAC *legal*? When Parliament passed the Air Corporations Act in 1949 they and the Government of the day thought it desirable that the chairman and deputy chairman of BOAC and BEA should be appointed from among members of the two boards.

Suitable wording was duly incorporated and enacted. You can turn it up in Section 2(2) of the Act:—

"The members of each of the corporations shall be appointed by the Minister, who shall also appoint the chairman and deputy chairman or deputy chairmen of each corporation *from among its members*" [my italics].

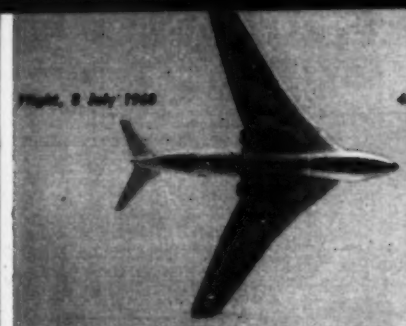
What the Minister did in the case of Sir Matthew Slattery, who was not a member of BOAC, was to appoint him "member and chairman" of BOAC. Which seems to me to make rather a mockery of the law.

Not that it matters all that much. It's just rather an amusing thought that the Ministry, which is always quick to jump on anyone who pulls a fast one on the Air Corporations Act, happens to have this little beam in its own eye.

● The author of a *Flight* article on British aircraft manufacturers' after-sales service recently visited a well-known British aviation company. "Oh, so you're the chap who wrote that article," snorted one of his hosts, adding: "Mind you, I haven't actually *read* it . . ."

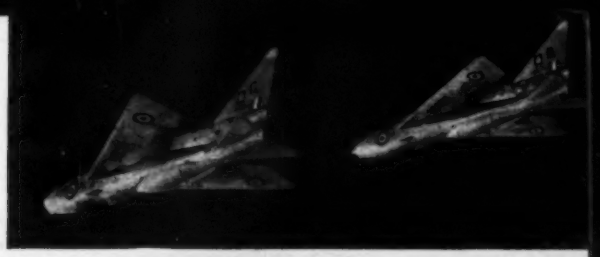
ROGER BACON

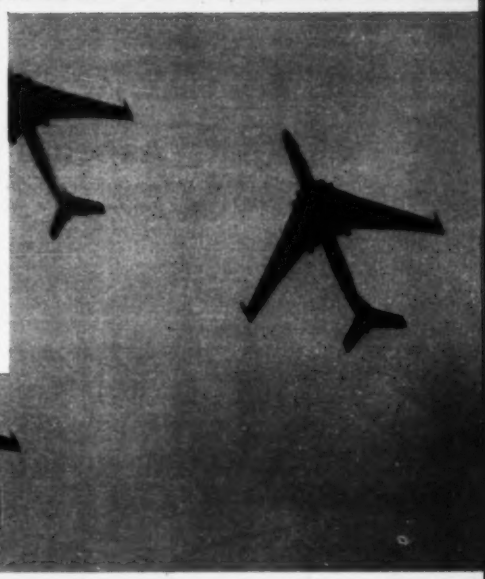
Answer to ballistic-missile technical problem: Cape Canaveral.



MILITARY AIRCRAFT OF THE WORLD 1960

A FLIGHT REVIEW



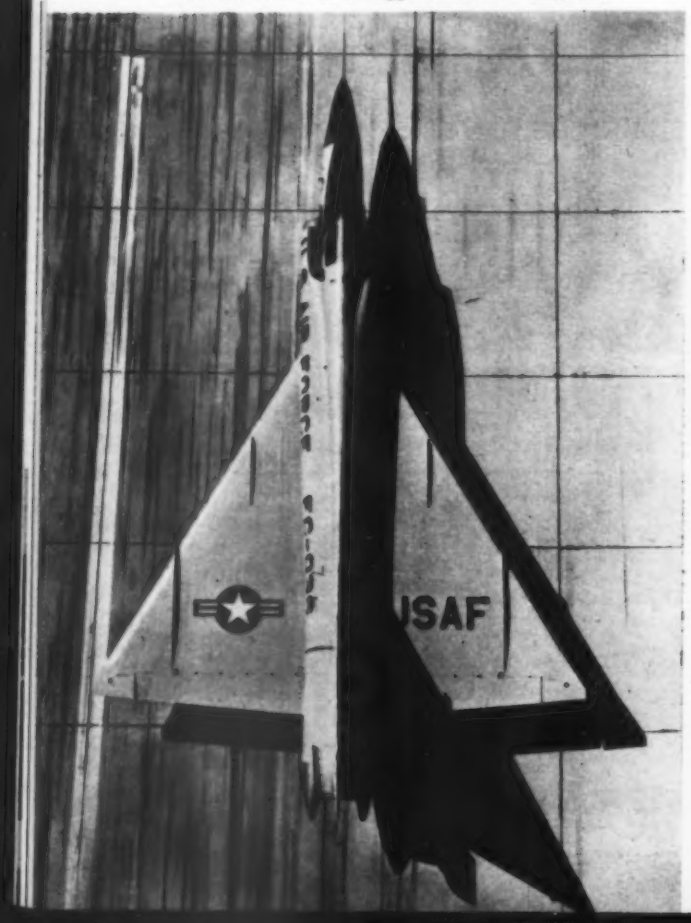


McDonnell F4H-1 Phantom 2 (two General Electric J79)

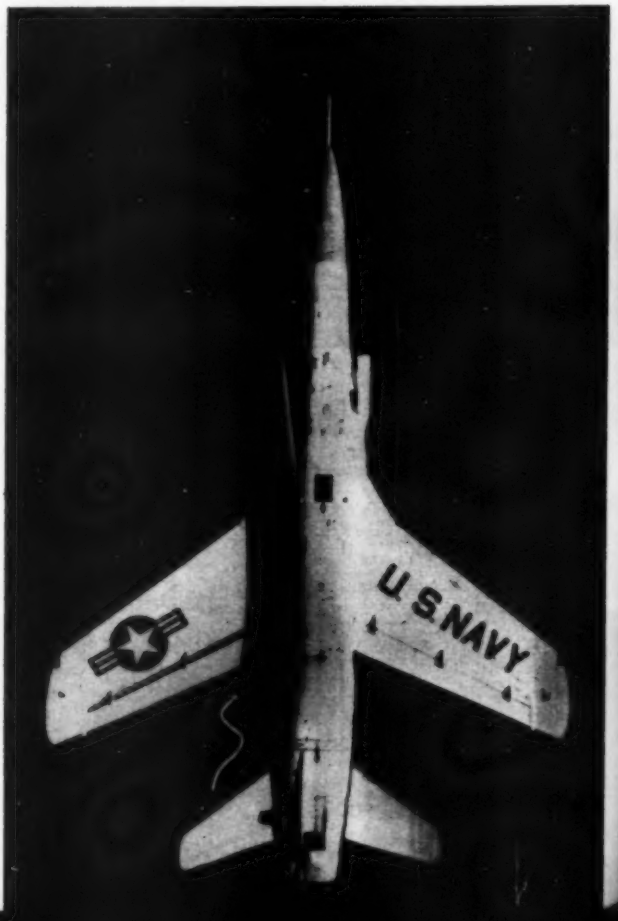
Republic F-105B Thunderchief (Pratt & Whitney J75)

Aspects of Fighter Design

Convair F-102A Delta Dagger (Pratt & Whitney J57)



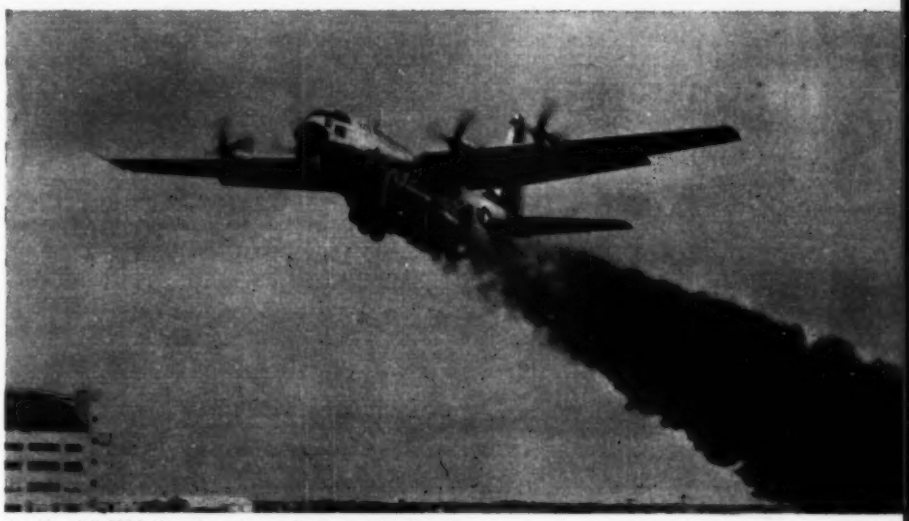
Grumman F11F-1F Super Tiger (General Electric J79)



North American F-100F Super Sabre streaming braking parachute at touchdown. (Right) Chance Vought F8U-1P Crusader on a carrier approach

MILITARY AIRCRAFT OF THE WORLD . . .

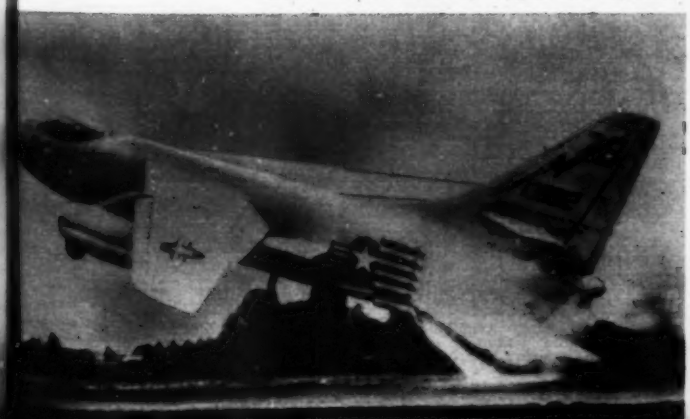
Take-off and Landing



Lockheed C-130B Hercules using rocket-assisted take-off

North American F-100F Super Sabre leaving zero-length launching platform

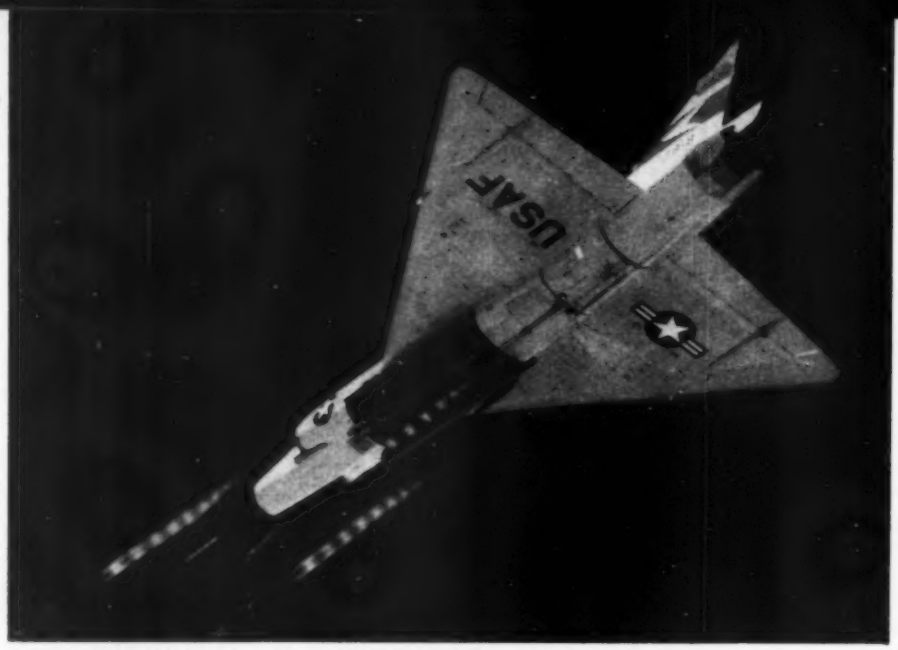
Rocket-assisted take-off by Douglas A3D Skywarrior



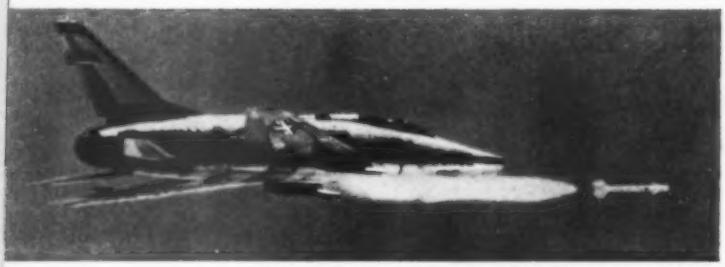
Douglas A4D Skyhawk on steam catapult

MILITARY AIRCRAFT OF THE WORLD . . .

Air-to-Air Armament



Convair F-102 Delta Dagger launching a salvo of internally stowed Falcon missiles



North American F-100 Super Sabre launching Sidewinder

McDonnell F3H-2M Demon launching Sparrow 3

English Electric Lightning firing spin-stabilized rockets from Microcell launchers

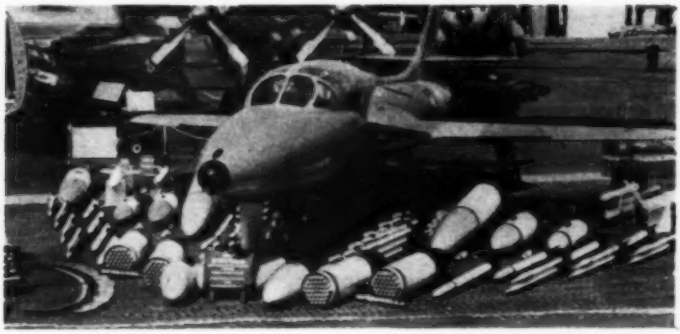
Below, Convair F-106A Delta Dart with Genie (nuclear) and Falcon missiles

Left, Chance Vought F8U-2N Crusader with Sidewinders

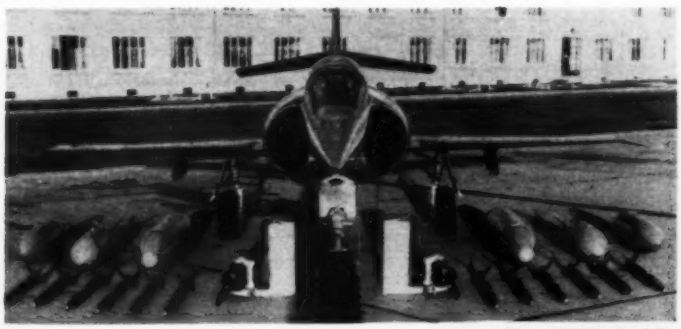
Northrop N-156F. Second on centre-line (shrouded) is a nuclear store

MILITARY AIRCRAFT OF THE WORLD . . .

Assorted Ordnance



Hawker Hunter Two-Seater



Marcel Dassault Etendard IV

Fiat G.91

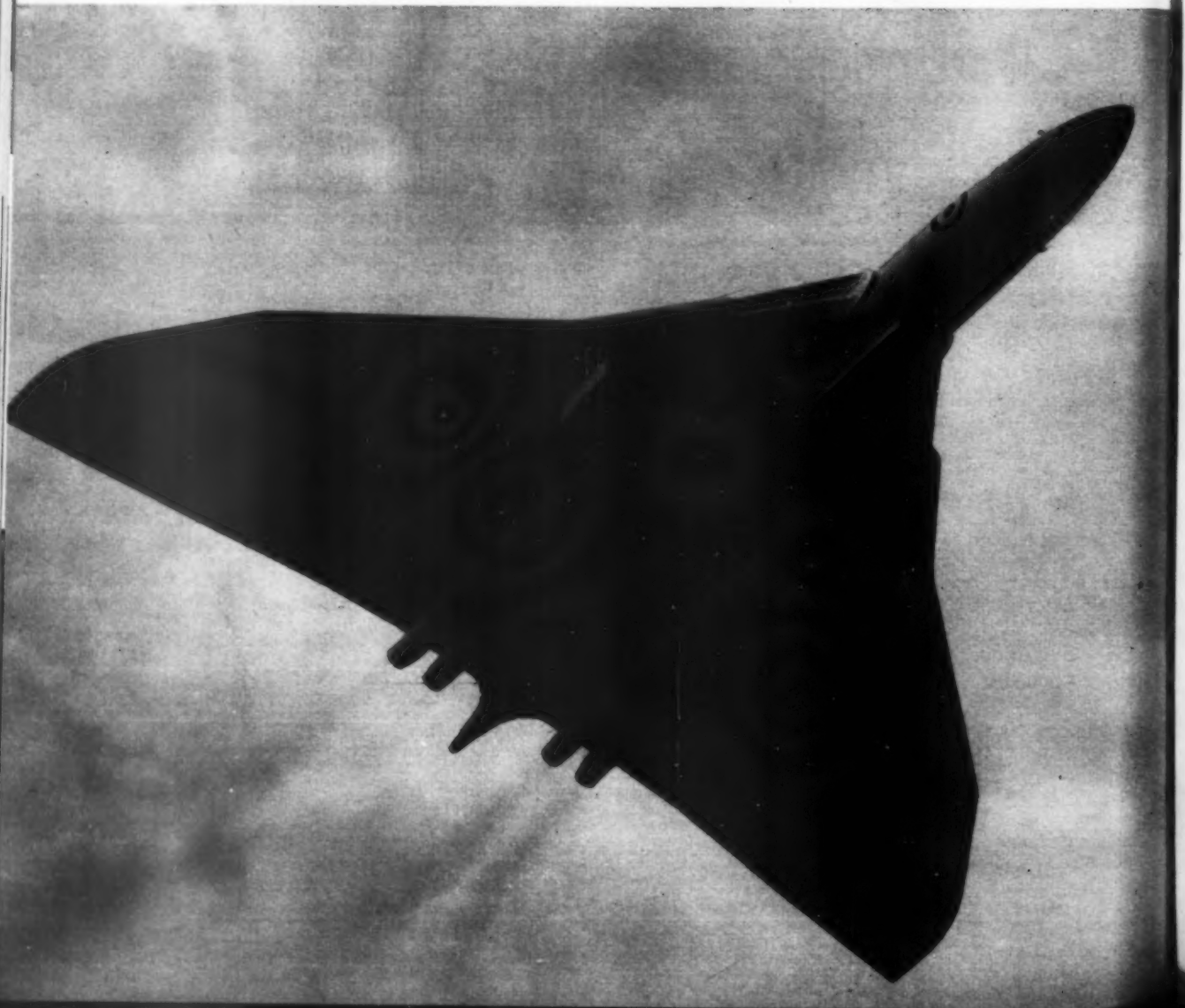
Republic F-105B Thunderchief

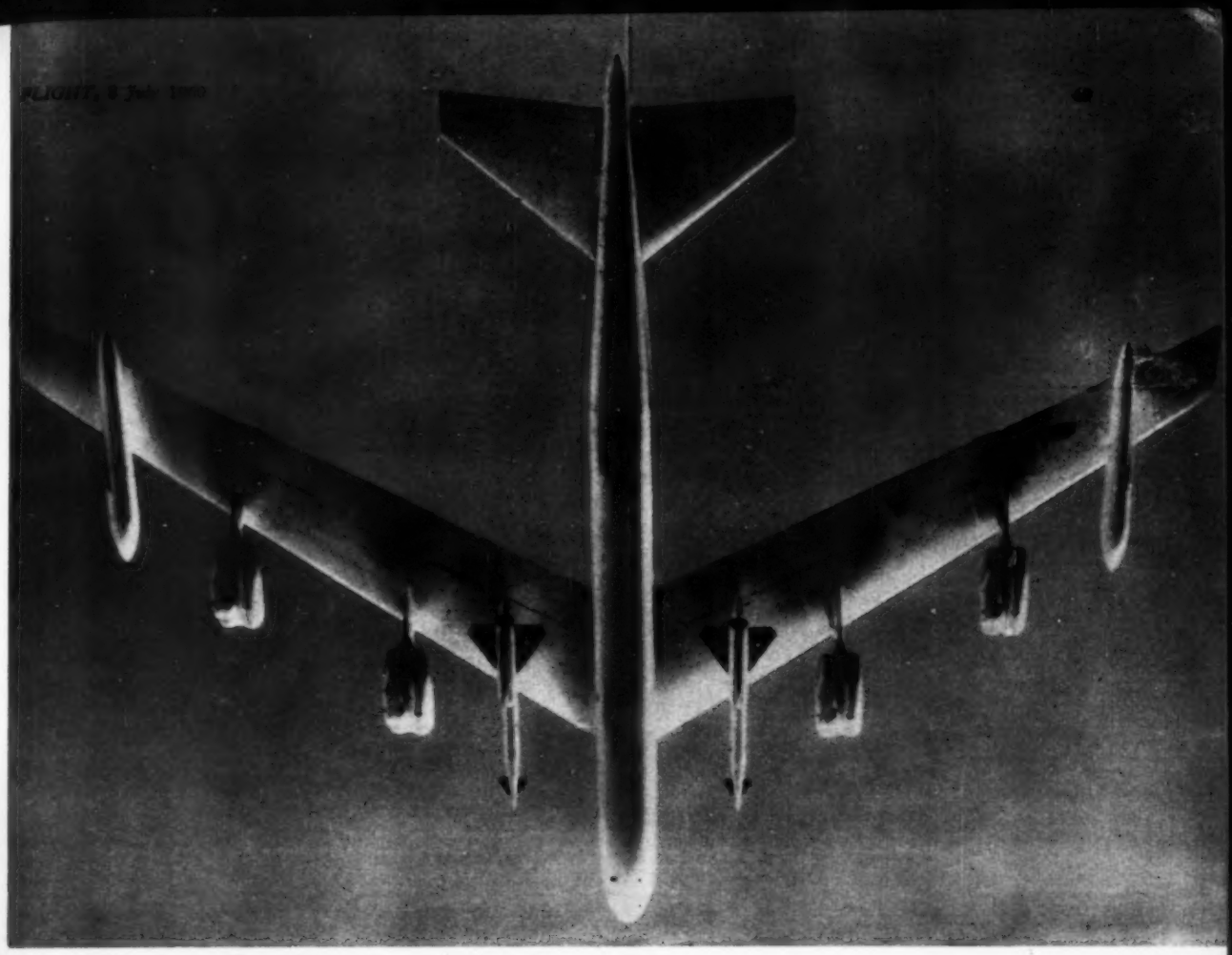
MILITARY AIRCRAFT OF THE WORLD . . .

Aspects of Bomber Design

Convair B-58A Hustler (four General Electric J79)

Avro Vulcan B.2 (four Bristol Siddeley Olympus)





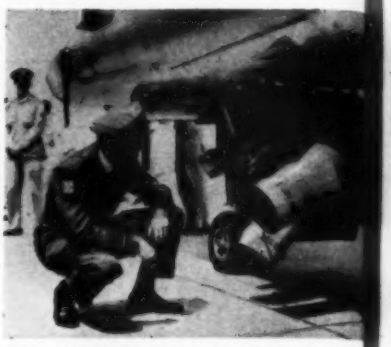
Boeing B-52G Stratofortress (eight Pratt & Whitney J57) carrying Hound Dog missiles

Handley Page Victor B.2 (four Rolls-Royce Conway)

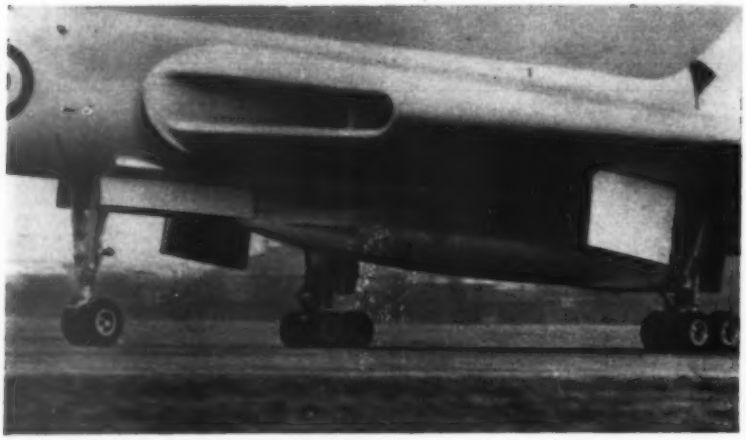
MILITARY AIRCRAFT OF THE WORLD . . .

Hound Dog stand-off bomb on Boeing B-52G

More Assorted Ordnance

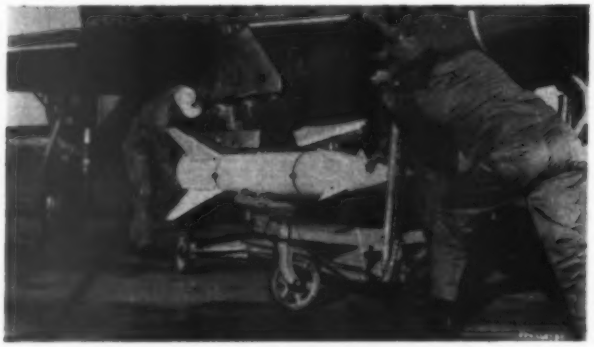


Prince Bernhard examining RF-101 cameras



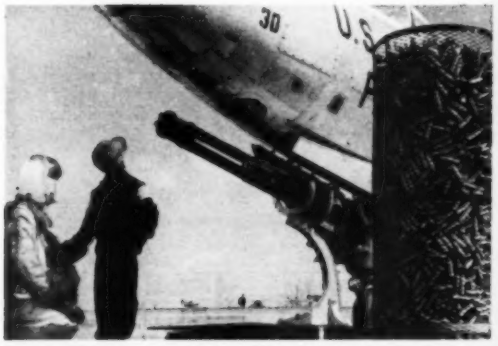
Avro Blue Steel stand-off bomb on Avro Vulcan

Gun panel (2×0.5in) for Fiat G.91



Loading Bullpup air-to-ground missile on F-100 Super Sabre

Below, Land Rovers being loaded aboard a Blackburn Beverley



American citizens examining M-61 20mm six-barrelled gun

Short platform freight-lift in operation with Bristol Britannia

MILITARY AIRCRAFT OF THE WORLD . . .

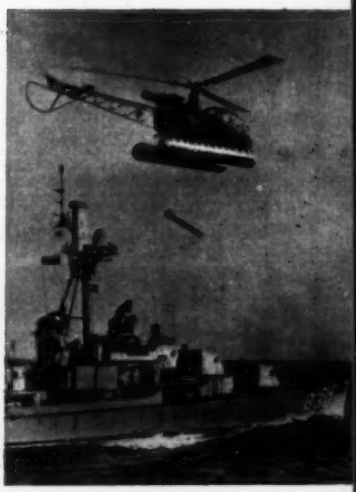
Right, Westland (Bristol) Belvedere transporting Bloodhound missile

Below, Bell HU-1A Iroquois carrying Nord SS.11 missiles

"Choppers" Live up to Their Name

Westland Wessex (left) and Gnome-Whirlwind Sud Alouette firing Nord SS.11 missiles

Sikorsky HSS-2 dipping sonar detection gear



Alouette dropping homing torpedo

Sikorsky S-60 disembarking troops from "pod"

MILITARY AIRCRAFT OF THE WORLD . . .

Great Britain

Armstrong Whitworth Argosy 660 As this special issue goes to press a repeat order for the Argosy 660 military transport for the RAF is announced. This order, which brings the total for the RAF up to 40, was foreshadowed by the Under-Secretary of State for Air in March this year, when he revealed that the first Argosy 660s are expected to be in service by 1962. It is also announced that an aerodynamic prototype, fitted with the Argosy 660's characteristic beaver-tail rear door for supply dropping, will fly during this month. The first definitive aircraft for RAF Transport Command should be in the air during December.

The purpose of the special beaver-tail stern (which might be better described as crocodile-jaw stern) is to allow the parachuting of heavy equipment. The makers point out that the aircraft has a high rate of climb (it is powered by four Rolls-Royce Dart RDa.8 military-rated turboprops) enabling it to regain cruising altitude quickly and resume pressurization after a heavy drop. Although intended primarily to fulfil a tactical role within Transport Command, the Argosy 660 has provision for in-flight refuelling which confers a long-range potential. Although basically a freighter, it will have applications also as a VIP or troop transport, for casualty evacuation, or as a mobile battle headquarters or for paratroop dropping. In the last-named role there are doors on each side of the rear fuselage so that simultaneous jumps are possible. Although the full-width front-opening door as fitted to the civil Argosy is not fitted to the Argosy 660s now under construction for the RAF, this can be built-in to customer requirements.

Used for freighting, the Argosy 660 will carry 14 tons of equipment, including guns, trucks and half-track vehicles. These are loaded on an integral ramp which is formed when the bottom half of the beaver tail is lowered and extended to the ground. The aircraft can be operated from grass strips and semi-prepared runways.

Span, 115ft; length, 86ft 9in.

Armstrong Whitworth (Hawker) Sea Hawk This carrier-borne or land-based fighter/bomber/reconnaissance single-seater continues in production. It is notable for its tractability and adaptability, and has been adopted not only by the Fleet Air Arm of the Royal Navy but by the Netherlands, Germany and India. The standard powerplant of the later variants is the Rolls-Royce Nene 103 of 5,400lb thrust. The Netherlands version—the Mk 50—has American radio equipment and has been adapted to carry Sidewinder missiles. The two German variants —the Mks 100 and 101—have increased fin and rudder area. This increase is only strictly necessary on the latter mark owing to the installation of EKCO Type 34 radar in an under-wing pod (the aircraft operates primarily in the radar reconnaissance role). Built-in armament is four 20mm guns and underwing provision is made in most marks for auxiliary tanks, bombs or rockets.

Span, 39ft; length, 39ft 8in; gross weight (without external stores), 13,200lb; gross weight (with two underwing tanks and two 500lb bombs), 16,200lb; max speed at s.l. (clean), 599 m.p.h.; initial rate of climb, 5,700 ft/min; radius of action with two 100gal wing tanks, 386 miles.

Model of Armstrong Whitworth Argosy 660 military transport

de Havilland Sea Vixen FAW.1 with Firestreak missiles

English Electric Lightning F.1 with Firestreak missiles

Auster AOP.9 This air observation post is in service with Britain's Army Air Corps, the Indian Army, and the Indian and South African Air Forces. The Blackburn Bombardier 203 delivers 173 h.p. on MT fuel and is equipped with a cartridge starter. The crew consists of a pilot and observer, the seat for the latter being at the rear and facing forward or aft as required. Quickly detachable armour-plate is provided for the pilot's position. There is space for a third seat alongside the pilot. In addition to radio there is provision for vertical photography, and four flares can be attached to a light bomb carrier under the fuselage.

Span, 36ft 5in; length, 23ft 8in; weight empty, 1,590lb; gross weight, 2,125lb; cruising speed, 110 m.p.h.; take-off (6 m.p.h. wind), 100yd.

Avro Vulcan B.1 Production of this mark of Vulcan strategic bomber has now ceased in favour of the B.2 version. The later machines of the series have Bristol Siddeley Olympus 104 engines of 13,000lb thrust. The weapon bay takes conventional or nuclear bombs which can be delivered with the assistance of a radar-controlled blind-bombing system. A Doppler radar, computer, astro sextants and other aids are carried for navigation; and probe-and-drogue flight refuelling is a standard fitting. HF/RT radio affords direct voice communication with ground stations almost anywhere in the world, and these can in turn be directly connected to a normal ground telephone system.

The Vulcan B.1 was described in detail in *Flight* of January 31, 1958, and a first-hand account of a bombing exercise was published on July 18, 1958.

Span, 99ft; length, 97ft 1in.

Avro Vulcan B.2 This enlarged and refined Vulcan carries the Avro Blue Steel stand-off bomb and even later developments will carry the Douglas Sky Bolt air-launched ballistic missile. The Blue Steel's development was discussed in *Flight* of March 11 last and a similar discussion in respect of Sky Bolt was printed in the issue of April 1. This last discussion was accompanied by an artist's impression of how the Vulcan might appear when carrying two Sky Bolts under its wing.

Aerodynamically the Mk 2 version differs from the B.1 in having an extensively modified wing of increased span. Dual-purpose control surfaces remove aerodynamic buffet limitations and enable the aircraft to take advantage of the Bristol Siddeley Olympus 201 Series engines of 17,000lb thrust or higher. These are started by a low-pressure air system charged by a Bristol Siddeley or Blackburn Palouste compressor. Production aircraft have a notably lengthened tailcone housing additional equipment and conforming to the area rule. As in the B.1 aircraft the crew normally numbers five, i.e., two pilots (with Martin-Baker ejection seats) and an air electronics officer, navigator and radar operator at the rear, facing aft.

Picture, page 48.

Span, 111ft; length, 97ft 1in.

Avro Shackleton MR.3 This is the latest operational mark of the Shackleton, the T4 being a conversion of the earlier Mk 1 pattern for use as a navigation trainer. The MR.3 has four Rolls-Royce Griffon 57A piston engines of 2,455 h.p. each. Its armament is two 20mm guns in the nose, and the weapons bay, of exceptionally large dimensions, will carry numerous combinations of bombs, homing torpedoes, mines, flares, etc. In the anti-submarine role the Shackleton is equipped to detect, track and attack. Initial long-range detection is by means of tactical searches and patrols, and in homings by radar and other special equipment on to buoys, ships, snort submarines and aircraft. Accurate fixing and short-range tracking of submarines is carried out using sonobuoys; and day and night attacks with torpedoes or depth charges complete the operational sequence. The crew numbers ten—two pilots, two navigators, a flight engineer, a radar operator, R/T operator, two sonics-equipment operators, and beam look-out.

Shackleton MR.3s have been supplied to the South African Air Force as well as to RAF Coastal Command. A machine of the type can, it is claimed, search 200,000 square miles of ocean during a single sortie. Under fully operational conditions an MR.3 has remained airborne for 24hr 31min.

Span, 119ft 10in; length 92ft 6in; gross weight, 100,000lb; max speed, 300 m.p.h.; service ceiling, 19,200ft; range at 200 m.p.h., 3,660 miles.

Avro 758 A projected development of the Avro 748 twin-Dart transport, possibly to be manufactured in India and to have rear loading doors permitting the dropping of equipment.

Blackburn NA.39 As yet unnamed, this notable low-level strike aircraft has been adopted by the Fleet Air Arm of the Royal Navy and is being carefully studied by land-based air forces who need a potent attack machine for sustained all-weather operations at low altitudes. The two de Havilland Gyron Junior turbojets are mounted one on each side of the fuselage and provide bleed air for extensive supercirculation over both the wings and the slab tailplane. There are full-span blowing slots immediately aft of the leading edge, ahead of the flaps and ailerons, and also beneath the tailplane, near the leading edge. An elevator-like trimming surface is unlocked at low speeds and the ailerons droop. To overcome the considerable residual thrust when high engine r.p.m. are

English Electric Lightning T.4 with Firestreak missiles

Blackburn NA.39 (pre-production aircraft)

needed to provide supercirculation on the approach, the 8ft-long tail-cone splits open to form extensive air-brakes of extreme effectiveness. To withstand the severe aeroelastic problems occasioned by operation at low level the NA.39 structure is particularly strong and fatigue resistant and makes extensive use of integrally machined components. To reduce drag at high speeds the whole airframe is markedly area-ruled. There is a long internal weapon bay with rotating doors and further space might house electronic equipment associated with air-to-surface guided missiles. No guns are fitted.

The crew of two sit in tandem beneath a sliding canopy and have a comprehensive assortment of navigation aids, evidently including Doppler. Ferranti are producing the navigation/terrain-clearance/weapon-delivery radar. The NA.39 could approach its target at a variety of levels, although the final run-up would generally be made beneath the enemy radar and missile cover. The LABS system would probably be used for the delivery of a nuclear weapon.

Span, 42ft 6in; length 62ft 4in.

Blackburn Beverley C.1 Although no longer in production, the Beverley represents an outstanding type of military transport aircraft with particular ability in the heavy dropping role. A load of 29,000lb of steel plate and other ballast has been dropped by eight 66ft G.Q. parachutes.

Picture, page 50.

Span, 162ft; length, 99ft 5in; gross weight, 143,000lb; max speed, 238 m.p.h. at 5,700ft.

Bristol/Short Britannia C.1 This is the standard type of Britannia for RAF Transport Command and is powered by four Bristol Siddeley Proteus 255 turboprops. It is distinguished from its civilian counterparts by the freight-loading door, measuring 74.5in by 93in, and by a corresponding increase in floor strength to withstand more than 16 tons of heavy freight. Some 117 passengers or 53 stretcher cases, or a combination of freight and passengers, can be taken.

To facilitate elevation of large indivisible loads to the 11ft 6in-high door sill, and stowage at the appropriate point on the floor, Short's design team have evolved a complete load-handling system tailored to the aircraft. The freight lift takes the form of a platform 14ft × 1ft, upon which loads up to 12,000lb in weight may be raised by an electrically operated cable system. The lift can be dismantled in some ten minutes (the largest portion then weighing under 250lb) and stowed aboard the aircraft.

Picture, page 50.

Span, 142ft 3in; length, 124ft 3in; weight empty, 88,250lb; gross weight, 180,000lb; cruising speed, 403 m.p.h.; still-air range with max payload, 4,480 miles at 357 m.p.h.

de Havilland Comet C.2 Although a relatively old member of the Comet family, the C.2 as now in service with RAF Transport Command is giving an account of itself, both in respect of reliability and performance, that is the envy of other air forces. This model seats 44 and has four Rolls-Royce Avon Mk 117 turbojets of 7,300lb thrust. Gross weight is about 120,000lb. Comets of a later series are likely to be acquired for the RAF.

de Havilland Sea Vixen FAW.1 A very comprehensive description of this potent naval all-weather fighter and strike aircraft was printed in *Flight* of February 5 last. The following is an extract indicative of the aircraft's potential: "Standard armament comprises the two secondary Microcell rocket packs stowed flush within the lower fuselage. Each houses fourteen 2in rockets, which can be fired singly, 'rippled' or fired in salvo while the packs are hinged down hydraulically. This armament is normally carried with all alternative primary loads. In the normal intercepter role the primary armament consists of four Firestreaks mounted on underwing pylons, two on each stub wing: in addition, two 200-gal droptanks can be carried on the heavy-store pylons on the outer wings. Alternatively, bombs, rocket carriers or launchers, or a mixed load can be carried—in fact, any airborne store in the current Navy repertoire . . . the Sea Vixen is equipped with the latest G.E.C. interception radar, which provides search, lock-on, blind firing and other facilities, and operates in conjunction with the Ferranti pilot attack sight. Navigational, flight-instrumentation, and communications equipment includes ground and air position indicators, a reference gyro (monitoring the instruments, autopilot and radar in pitch and roll), the latest type of flight-instrument presentation with full freedom about all axes, TACAN, UHF, radio altimeter, and a Louis Newmark autopilot providing for height, speed or Mach hold as well as yaw and pitch damping." The manufacturer's chief test pilot reports that the high thrust from the two Rolls-Royce Avon engines permits very tight loops to be flown at surprisingly low speed, though on the other hand a gentle loop or roll off the top from high speed at low altitude will occupy some 18,000ft of sky! The latest Sea Vixens have provision for in-flight refuelling.

Span, 50ft; length, 53ft 6in.

English Electric Lightning F.1 This is the new standard all-weather fighter for the RAF and is powered by two superimposed Rolls-Royce Avons of late mark. An RB.146 Avon on the Rolls-Royce stand at last year's SBAC Display was labelled "upper engine," indicating that this very advanced unit is intended.

The circular nose intake admits air round a centre "bullet" accommodating the Ferranti Airpass fire-control radar which, together with an autopilot, ensures that all types of interception can be made automatically, leaving the pilot to supervise the overall operation. It was announced early last year that, during routine testing, the Lightning has reached Mach 2 in level flight and maintained this speed with minimum reheat.

Armament can include two de Havilland Firestreaks attached by pylons to a pack installation beneath the forward fuselage and two Aden 30mm guns flanking the cockpit. The missile pack can be replaced by a twin-Aden gun pack or two batteries of unguided rockets stowed internally. In addition to the autopilot the Lightning has the latest roller-blind flight instrument system. It is in fact equipped for night and day all-weather operation, and has often demonstrated its ability to land with a ground-run of about 1,000yd. There is still considerable development potential and it has been stated that the aircraft is capable of accommodating the larger and more powerful missiles now being developed.

Span, 34ft 10in; length, 50ft.

English Electric Lightning T.4 This trainer development of the Lightning has side-by-side seats and carries Ferranti Airpass and a twin-Firestreak pack but no guns. Operational employment is possible and, like the single-seat Lightning, this aircraft is doubtless capable of extensive development.

English Electric Canberra (B(I).8 The phenomenal success of the Canberra as a bomber, attack and interdicter aircraft, trainer and photographic reconnaissance machine call for no recapitulation here, although it may be mentioned that more than 800 Canberras of all types have been built in Britain, quite apart from American production. the B(I).8 carries Doppler radar and LABS bombing equipment (for nuclear attack) and pylons for a 1,000lb bomb. Bomber Canberras accommodate a pilot and two navigators side-by-side behind, while the B(I).8 has a bubble canopy offset to port for the pilot and a seat in the nose for a navigator/bomb-aimer. A description and cut-away drawing appeared in *Flight* for March 14, 1958. The engines are two Rolls-Royce Avon 109s.

As used by the Indian Air Force this aircraft is known as the B(I).58.

Span, 64ft; length, 66ft 8in; gross weight, 55,000lb; max speed, 600 m.p.h.

English Electric (Short) PR.9 Developed for photographic reconnaissance at all altitudes—particularly at great height—this mark of Canberra has a larger wing, the span being increased by 4ft and the centre-section chord very considerably extended. Like the B(I).8 this mark has an offset fighter-type canopy. The nose section has been redesigned by Shorts to permit the installation of an automatic ejector seat for the navigator. This project involved, in addition to structural modifications, the redistribution of all navigational and photographic equipment within an area approximately half that available in the Canberra PR.9 The navigator's entrance door has been replaced by hingeing the front portion of the nose to open just forward of the seat, and two windows have been introduced, one on each side above the port and starboard control consoles. Ejection is through a frangible hatch in the upper fuselage. The turbojets are Rolls-Royce Avon Mk 206s.

Fairey Gannet AS.4 This was the last operational mark of the anti-submarine Gannet to enter service (the T.5 was a trainer). Powered with

Fairey Gannet AEW.3

English Electric (Short) Canberra PR.9

Folland Gnat Trainer and Gnat

Gloster Javelin FAW.8

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a Bristol Siddeley Double Mamba 101 turboprop of 3,035 e.h.p., the Mk 4 aircraft has internal and external provision for bombs (500, 1,000 and 2,000lb), depth charges, mines, homing torpedoes, marine markers, sonobuoys and flares. Underwing stowage is provided for two 1,000lb stores or combinations of rocket projectiles. The crew of three are housed in separate cockpits.

Span, 54ft 4in; length (over hook), 44ft 6in; weight empty, 15,070lb; normal gross weight, 19,600lb; max speed, 310.5 m.p.h.; economical cruise for endurance, 149.5 m.p.h.; range (max fuel, normal allowances), 943 miles.

Fairey Gannet AEW.3 This is the last production-type Gannet and is intended for early warning in Fleet Air Arm service as a replacement for the Douglas AD-4W Skyraider. The massive radar scanner is the most notable among numerous changes from earlier marks. The legs of the undercarriage have been lengthened and in order to accommodate them the wing has been modified. The latter is completely de-iced by Napier Spraymat elements, which are also fitted to the leading edges of the triple-fin tail and to the intake of the Bristol Siddeley Double Mamba, the latter being the most powerful version of this engine. The pilot of the AEW.3 sits alone above the nose and two radar observers occupy the rear cabin.

Span, 54ft 6in; length (without hook), 44ft.

Folland Gnat Mk 1 Although at present Folland aircraft are concentrating on the Gnat Trainer, the Mk 1 calls for mention as a notable light fighter/bomber already supplied to the Ministry of Aviation, India, Finland and Yugoslavia. Weighing 6,250lb in the intercepter configuration, it is powered by a Bristol Siddeley Orpheus 701 of 4,700lb thrust, which affords spectacular acceleration and climb, and M1 can be exceeded in a shallow dive. The fully powered slab tail carries an elevator surface which may be unlocked for reversion to manual control in emergency. The inboard ailerons droop automatically when the undercarriage is lowered, and partial extension of the latter allows the fairing doors to act as airbrakes. Armament consists of two 30mm Aden guns, with a radar-ranging sight, and a full range of underwing stores or tanks carried on pylons.

Span, 22ft 2in; length, 29ft 9in; gross weight, up to 8,600lb; limiting Mach number, 0.98.

Folland Gnat Trainer Mk 1 A very complete description of this trainer, already adopted by the Royal Air Force, appeared in *Flight* of November 27, 1959. The instructor occupies space previously used for equipment and fuel; the latter have been moved respectively into the nose and the former gun compartments. The fuselage is lengthened by 9in. The new wing, of 175 sq ft area and 7 per cent t/c ratio, houses 100 gal of fuel in integral tankage round the multiple spars. Outboard ailerons and inboard flaps are fitted, providing low-speed handling suitable for a trainer without compromising high-speed performance. All tail surfaces are of increased area and the powerplant is a Bristol Siddeley Orpheus 100 of 4,230lb thrust. The airframe is designed for a ten-year life of 5,000hr flying. A power-operated slab tailplane, with an elevator which can be unlocked for manual flying, is retained. The rudder is mechanically operated against feel springs and reversion of the powered ailerons to manual control is automatic. The Trainer will be cleared for spinning with drop tanks in place and will be able to operate from 6,000ft runways in any weather.

Span, 24ft; length, 30ft 9in; empty weight, 5,140lb; gross weight, 7,500lb; limiting Mach number, 0.97.

Folland Gnat Mk 2 This fighter/bomber development would have a 6 per cent wing, permitting a Mach number of 1.5 on the power of a late-mark Bristol Siddeley Orpheus. There would be equipment for all-weather operation.

Folland Gnat Trainer Mk 2 This supersonic project is based on the same forward and centre fuselage as the Mk 1, but having a wing of 150-160 sq ft and 5 per cent t/c ratio, fitted with high-lift trailing- and full-span leading-edge flaps and advanced lateral-control devices. These features would permit supersonic level flight while maintaining stalling and low-speed characteristics suited to training and carrier-borne operations. The Orpheus engine would have a Bristol Siddeley reheat system. Integral tankage would allow almost the same endurance as that of the Mk 1 Trainer, but a speed of M1.5 and a time to 50,000ft of 3.5min from brakes off would be possible.

Gloster Javelin (late marks) An account of a visit to Gloster Aircraft to see conversion work on Javelin all-weather fighters (production of new aircraft is now completed) appeared in our issue of May 20. On the same occasion we gave this note on the three latest marks of this standard RAF all-weather fighter: "The FAW.7 introduced the Sapphire 7 engine of 11,000lb dry thrust. This mark was also the first to carry the D.H. Propellers Firestreak air-to-air missile, four of which are hung on underwing pylons. The associated aircraft-mounted units of the system are carried in the fuselage. A British radar set is fitted, and the rudder is provided with a yaw damper. The FAW.8 was the first mark to have the Sapphire with limited reheat, giving 12,390lb thrust, and other equipment includes American radar equipment, drooped leading edge, dampers on both yaw and pitch axes and a Sperry autopilot. The Mk 9 is essentially the Mk 7 converted to Mk 8 standard, differing from the 8 in having a British radar. At present Gloster are not installing an autopilot in the Mk 9 aircraft, but all are being equipped for flight refuelling, for which purpose a huge fixed probe can be attached high on the starboard side of the forward fuselage."

Span, 52ft; length, 56ft 4in.

Handley Page Victor B.1 Two notable articles on this standard RAF strategic bomber have appeared in *Flight* during recent months. The first—on October 30, 1959—was a detailed technical description of the airframe and also an account of development. The second (April 8, 1960) described a flight in the Victor and is recommended as an intimate insight into the operation of a modern bomber.

The Victor B.1 has four Bristol Siddeley Sapphire 200 Series turbojets and it is the makers' proud claim that during 1957 an aircraft of this mark exceeded the speed of sound by a margin of about 15 m.p.h. and at a height of about 40,000ft. A crew of five is accommodated in the nose section, which carries a large bombing and navigation radar in its lower part. Excellent handling characteristics result from the use of high-lift flaps and drooping leading edges, in conjunction with a high-set tailplane. The eight-wheel bogies of the main undercarriage unit retract rearwards to lie within the wing and there are large airbrake surfaces at the rear end of the fuselage.

Span, 110ft; length, 114ft 11in.

Handley Page Victor B.2 Armed with the Blue Steel stand-off bomb this much improved mark of Victor is likely to remain in service with Bomber Command for some ten years to come. Four Rolls-Royce Conway RCo.11 turbojets, each of 17,250lb thrust, are installed and there are some notable external differences including increased wing span, enlarged air intakes and retractable scoops just forward of the tail fin. When extended these scoops draw in ram air to drive turbo-alternators for high-altitude emergency auxiliary power. Auxiliary power for use at low altitude is supplied by a Blackburn Artouste gas turbine

Left, Hunting Jet Provost T.3; below, Hawker Hunter FR.9 and Hunter Two-Seater T.66A; right, Hawker Hunter F.6

Scottish Aviation Twin Pioneer

Short Britannic (artist's impression)

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in the starboard wing root. On the ground the Artouste is used for starting the Conways, thus rendering the Victor B.2 independent of outside assistance on remote airfields. The latest version of the Victor B.2 to be seen has a small dorsal fin with a built-in intake.

Span, 120ft; length, 114ft 11in.

Handley Page Dart Herald Although at present being promoted principally as a civil feederliner, the Dart Herald has obvious military applications, not only in the transport role but as a radar calibration aircraft and flying classroom.

Hawker Hunter (Single-seater) The latest basic mark of single-seat Hunter fighter/attack aircraft is the F.6, supplied to India as the F.56 and to Switzerland—with braking parachute—as the F.58. Other air arms supplied include those of Belgium, Holland, the Lebanon and Jordan, in addition, of course, to the Royal Air Force. The F.6 was fully described and illustrated in *Flight* of May 9, 1958. Particular interest attaches to the aircraft in the ground attack role, for which duty it can carry four 1,000lb bombs, thirty-six 3in rocket projectiles or four Microcell rocket pods each containing 36 × 2in. The built-in armament is four 30mm Aden guns and external tankage includes jettisonable units of either 100 or 230gal capacity in any symmetrical combination. Up to four 100gal napalm tanks can be taken. In the clean, intercepter configuration the Hunter F.6 weighs 17,600lb, carries 390 Imp gal of fuel internally, can attain 621kt at sea level, climb to 46,000ft in 6.75min, and has a ceiling of 53,400ft. Carrying an additional 660 Imp gal of fuel externally the Hunter weighs 23,700lb and can fly 1,610 n.m. With two 1,000lb bombs and two 100gal drop tanks it has a radius of action of 190 n.m. cruising at 1,000ft and 305 n.m. when cruising at 39,000ft. In both cases a 5min ground-level period is allowed for the attack. The engine is a Rolls-Royce Avon 203. Among the most recent specialized developments of the F.6 are the FGA.9 attack aircraft for the RAF and the FR.10 fighter/reconnaissance version, which carries a battery of cameras in a modified nose.

Span, 33ft 8in; length, 45ft 10½in.

Hawker Hunter Two-seater Hunter Two-seaters have been supplied to the RAF, the Royal Navy and the Danish, Dutch and Indian Air Forces. The most advanced is the T.66 for India, powered by the Rolls-Royce Avon Mk 203 and having two 30mm guns whereas one is normally specified for the two-seat version. A tail parachute is fitted and on the T.66A (Hawker's own demonstrator) there are Dunlop brakes with Maxaret on the nosewheel, permitting particularly short landing runs. All Two-Seaters can carry underwing armament stores or tanks. Like the Hunter single-seater, the Two-Seater easily exceeds Mach 1 in a shallow dive. The T.66 reaches 40,000ft in just over 6min, clears 50ft after a run of 3,150ft, and lands, again from 50ft, in 3,000ft when employing the braking parachute.

Hawker P.1127 This vertical take-off strike aircraft, the first prototype of which is due to fly this autumn, promises to be one of the most notable military aircraft to appear since the war. It is powered by a "special Bristol Siddeley engine," believed to be the BE.35 turbofan. Dr S. G. Hooker, Bristol Siddeley's technical director (aero), has discussed an engine of this character in the following terms:—

"It can be mounted horizontally in the fuselage of a single-seater aircraft in a conventional manner; the jets can always be directed rearwards, and the aircraft used for conventional take-off and landings; the engine can be started, tested and the machine taxied, with the jets directed horizontally rearwards, obviating problems of ground erosion and debris entering the engine during these phases; for short take-offs (say, 200yd) the aircraft can be accelerated with the jets directed rearwards, and then the nozzles can rapidly be deflected downward, to, say, 60°, when 87 per cent of the thrust of the engine will be given in lift, and half the thrust of the engine will still be available for horizontal acceleration. In such cases the aircraft will clearly sweep its debris behind it well away from its own intakes; even for vertical take-off the engines can first be opened up to full power, and then the nozzles rapidly deflected vertically to give the minimum time for jet erosion and debris to be thrown around; combining, as it does, both lift and thrust in one engine, the BE.53 keeps the maintenance and logistic problems due to dispersal to a minimum." It may also be noted that an aeroplane powered by a BE.53 can operate in a conventional manner when a runway is available and also that the jets may be deflected forward in flight in order to give reverse thrust for very high deceleration, steep descent and short (or vertical) landing.

Hunting Jet Provost T.3 A visit to the RAF's No 2 Flying Training School to study the work of the first course of pupils to be taught to fly on Jet Provost T.3s was described in *Flight* of April 1. On that occasion the manifold qualities of the aircraft were illustrated. Earlier marks of the Jet Provost have been in service for some years but are considerably less refined than the T.3, with its Bristol Siddeley Viper ASV.8 of 1,750lb thrust, clear-view canopy, Martin-Baker Mk 4 lightweight ejector seats and other improvements. Full dual controls are fitted and there is a single centrally mounted blind-flying panel. The hydraulically operated nosewheel undercarriage has a track of over 10ft 8in, and there are air brakes ahead of the flaps. A Rebecca Mk 8 set gives distance measuring

Miles Student

and bearing facilities and the Jet Provost T.3 is the first RAF trainer to have UHF instead of VHF radio. The Air Ministry themselves report on the aircraft in these terms:—

"The Jet Provost is an extremely docile aeroplane, yet it can give a lively aerobatic performance, as evidenced by the Central Flying School's outstanding exhibitions at Farnborough and other air displays. Because of this it can be used right from the *ab initio* stage up to the point where the student is a competent and confident light-jet pilot, ready in every way to go on to the advanced trainer. In this respect it is superior to the tail-down piston-engined Provost, the step from which to the Vampire Trainer was far greater than that from the Jet Provost, which has a power/weight ratio roughly similar to the Vampire's. The Jet Provost's spinning characteristics are good; its rate of roll is fast, and take-off and landing are extremely simple. Its engine-handling techniques are in line with those required by the more powerful jet engines and its response admirably prepares the student for the Vampire."

An armed version is available as a light attack or police aircraft.

Span, 36ft 11in; length, 32ft 5in; weight empty, 4,347lb; gross weight, 7,200lb; max speed, 326 m.p.h.; s.l. rate of climb, 2,400ft/min; ceiling, 33,000ft; take-off to 50ft, 1,990ft.

Hunting Pembroke Supplied to seven air forces for military transport and other duties, the Pembroke is powered by two Alvis Leonides engines. Six stretcher cases can be taken in the ambulance role.

Miles Student The Student (Blackburn-Turboméca Marboré) is already known as a trainer. Last year the makers put up a scheme for a land-carrier based on a "Queen Mary" type vehicle and capable of transporting, launching and retrieving a flight of three of these aircraft, operating in the attack/reconnaissance role. This scheme was criticized on the grounds that it was too large for ease of movement in forward areas and might be difficult to hide. An alternative scheme was then proposed, using two small vehicles each capable of carrying one Student, together with the components of the catapult and arrester system. The makers describe the scheme thus:—

"The structure and mechanism envisaged for this system are broken down into easily handled sections which can be assembled for use and dismantled for transportation very quickly and easily by a ground crew of three men. The aircraft is launched from a platform approximately 20ft × 14ft running on guide rails about 100ft in length. Energy for the catapulting operation is supplied by compressors mounted on both vehicles through storage vessels operating at a moderate pressure ratio. Duplication is proposed on grounds of reliability and only one compressor need be used for normal operations. The pneumatic ram is no more than 20ft in length and is connected to the launching platform through a simple cable and pulley arrangement employing the principle of the 'block and tackle.' The ram is pressurized to absorb the landing energy during the arresting operation in which the aircraft hook engages in cables which are raised automatically from the launching trolley. These cables are attached to simple shock absorbers which take only the initial shock on engagement—the bulk of the landing energy is absorbed through the movement of the trolley along its guide rails, the pneumatic ram serving as a main shock absorber and being restrained from recoiling by a mechanical or hydraulic lock system. A simple rack and sprag system prevents recoil. A small auxiliary arrester net of the type originated by Miles and now in fairly widespread use on runways and carriers is provided . . ."

Typical armament would be two Oerlikon or Microcell rocket pods.

Span, 32ft 6in; length, 31ft 9in.

Scottish Aviation Twin Pioneer The work of the Twin Pioneer in RAF service was exemplified in an article in *Flight* of August 21, 1959, and the flying characteristics of the latest version—the Series 3 with Alvis Leonides 531/8 long-stroke direct-injection engines—were described last week (July 1). Like the single-engined Pioneer, the "Twin" can operate from rough improvised strips no more than 300yd in length. Military roles are listed as communication, troop transport, paratrooping, air freighting, casualty evacuation, supply dropping, high explosive and anti-personnel bombing, and inter-theatre ferrying. Two 1,000lb bombs, or their equivalent weight to a maximum number of four, can be carried on racks mounted in stub wings.

The following data apply to the Twin Pioneer Series 3:—

Span, 76ft 6in; length, 45ft 3in; basic weight, 10,062lb; max take-off and landing weight, 14,600lb; max payload, 19 passengers or 4,000lb freight; cabin volume, 730 cu ft; speed at max cont power at 2,500ft, 158 m.p.h.; take-off distance to 50ft, 1,150ft.

Westland Westminster

Westland (Saunders-Roe) Wasp

Vickers-Supermarine Scimitar F.1

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Short Britannic 3A This is the version of the Britannic which is being developed for RAF Transport Command. It is powered by four Rolls-Royce Tyne RTy.12 turboprops each developing 5,730 e.h.p. and the design philosophy behind an aircraft of this type is summarized by the makers in the following terms:—

"Design of a freighter aircraft begins with the fuselage, and the size and shape of this are dictated by the need to carry a really substantial payload and to accommodate the most awkward and bulky types of cargo. A fuselage conditioned by this requirement is not suited to really high jet speeds. Moreover, for any given job, a jet-powered aircraft must be 30 to 40 per cent larger than one using propellers—since it must carry a vastly greater quantity of fuel—and will be proportionately more expensive. Development costs must inevitably be far greater and in the civil field such an aircraft will be hopelessly uneconomic, except conceivably on a few routes in the USA where freight traffic can be guaranteed and utilization kept abnormally high."

The Britannic 3A will carry its capacity payload of 85,000lb over 1,150 miles at 340 m.p.h. with 20 per cent fuel reserves, and with its capacity fuel load of 81,200lb it will carry 25,000lb of payload over 5,050 miles at 340 m.p.h., again with reserves. There is a large ramp door at the rear and a large loading door on the port side at the forward end of the hold. Including the rear ramp the hold is 80ft long, has a maximum height of 13ft 9in, a floor width of 12ft, and a maximum width of 16ft. A removable floor enables an upper deck to be added over any section forward of the wing and also—in special cases—at the rear. Overall cargo space of rectangular section is 10,000 cu ft, and the curve of the fuselage walls provides additional stowage. A total of 201 troops—153 on the lower deck and 48 on the upper—can be carried in six-abreast seats. With the rear loading ramp open in the level position supplies can be rapidly parachuted and for this purpose a roller-conveyor system is installed. Typical loads would comprise two 25-pounder guns, a 1-ton truck and miscellaneous freight; or two ½-ton trucks, a scout car and miscellaneous palletized equipment.

Span, 158ft 9in; length, 136ft 5in.

Short VTO Projects The possibilities of vertical take-off and landing (by means of jet lift) are being very actively investigated by Short Brothers & Harland Ltd as the outcome of their unique experience with the SC.1 research aircraft, fully described—and discussed by Mr H. G. Conway, joint deputy managing director and chief engineer—in *Flight* of June 10. Mention was made on that occasion of the Rolls-Royce RB.153 engine, said in France to have a thrust of 4,960lb, and, according to British reports, having a thrust/weight ratio of 16 : 1. Our discussion read: "This powerplant has been chosen by Short & Harland for a number of design studies. Such a machine would have supersonic capability but would spend most of its life at around M0.9 at low altitudes. The dead weight in cruise of the lift engines would be largely, if not entirely, counteracted by the diminutive size of the wing, rudimentary undercarriage, reduced drag, need for less diversion fuel, and by several other factors. Aircraft of this type could be deployed in quantity in seven to eight years. It is Short's view that the stabilization system would account for some 18 per cent of the cost of any aircraft of this type." A Short design study for a strike aircraft was depicted. This had four tip-mounted dual-purpose engines, supplemented by a battery of lift engines in the forward fuselage.

Vickers-Supermarine Scimitar This twin-Avon carrier-borne fighter/bomber is thoroughly established in Fleet Air Arm service. Built-in armament is four 30mm Aden guns and there are four universal pylons beneath the wing for the carriage of 200gal drop-tanks or any type of weapon up to 2,000lb per pylon. Approach speed is reduced by compressor-bled air blown from spanwise slots over the top of the flaps. Blowing starts automatically when the flaps are lowered more than 10°. Some flying and carrier deck impressions by a Scimitar pilot were printed in our issue of April 15 last. Among his observations was the following:—

"One of the more impressive sights at sea today is that of a Scimitar squatting at an attitude of 12° on the catapult, waiting to be launched. Pilots accustomed to the less extreme habits of Sea Hawks and Venoms understandably tend to view the whole performance with some apprehension at first. However, it looks more forbidding than it feels and the launch given by steam boosters is considerably smoother than was available with the earlier hydraulic systems."

Span, 37ft 2in; length, 56ft 2in.

TSR.2 A contract for the development of this tactical support and reconnaissance aircraft (two advanced Bristol Siddeley Olympus) was placed with Vickers-Armstrongs who were to share the work on a 50-50 basis with English Electric. Both firms are now members of the British Aircraft Corporation. It has been stated that the aircraft will have a radius of action of at least 1,000 miles, that it will be equipped with very advanced navigating and bombing equipment, and that it will take off on operational missions using as little as 600 yards of runway. In recent weeks it has been reported that the project has been the subject of a reappraisal.

Vickers-Armstrongs Valiant This four-Avon bomber continues in first-line RAF service. Among the most notable operational developments is the incorporation of Flight Refuelling equipment.

Vickers-Armstrongs VC10 There is a likelihood that this four-Conway airliner may be developed as a military transport, and possibly also as a launching vehicle, for Sky Bolt missiles. A Super VC10 was described in *Flight* last week.

Westland Helicopters The development and production of Fairey, Bristol and Saunders-Roe helicopters is now in the hands of Westland Aircraft Ltd, and the addition of these machines to the Westland range offers a military-helicopter potential unequalled by any other company in the world. The essential characteristics of the entire Westland family of helicopters were given in our special "Helicopters of the World" number dated May 27.

The **Skeeter** (D.H. Gipsy Major) is standardized by Britain's Army Air Corps and is employed as an air observation post. The RAF has adopted the type for training. Provision is made for two stretchers mounted externally.

The **Widgeon** (Alvis Leonides) is offered as a trainer, ambulance, search and rescue aircraft, and for anti-submarine detection, using a detachable pack containing sonar gear.

The **Wasp,** to be powered in its production version by the Blackburn Nimbus free turbine, is another helicopter with excellent military multi-purpose potential, e.g., reconnaissance, liaison, rescue, shore-based or seaborne weapon carrier, casualty evacuation, transport or turbine training. Guns, rockets or wire-guided missiles can be carried, and naval stores such as mines or homing torpedoes may be attached beneath the fuselage.

The **Whirlwind** (at present with Alvis Leonides Major and ultimately with de Havilland Gnome) is another multi-purpose type for which the following military duties are listed: transport for ten passengers; winch rescue with an hydraulically powered hoist, lifting two people; anti-submarine operations, carrying either submarine search equipment or a strike weapon; ambulance work, carrying six stretchers and a medical attendant; freight duties with a 2,000lb lift on an external sling; towing ships or ground equipment. The Gnome-engined Whirlwind offers higher payloads or additional fuel for longer range and "high and hot" performance will be notably improved.

The **Wessex 1** (Napier Gazelle) is already in quantity production as an anti-submarine helicopter for the Royal Navy but has demonstrated other military capabilities, notably as a crane-transporter. Advanced search equipment and strike weapons, including homing torpedoes, are specified.

Picture, page 51.

The **Wessex 2,** now in the project stage, will have two de Havilland Gnome shaft turbines and is being considered by the RAF and the Royal Navy.

The **Belvedere** (two Napier Gazelle) is in full production for the RAF. Intended roles are military engineering, casualty evacuation, troop transport, strategic and tactical logistics, assault, paratrooping, rescue and combat. In the last-named role soldiers could be carried into action and the Belvedere could then function as an observation and reconnaissance post or as a fighting craft, armed with guns or rockets or guided weapons.

Picture, page 51.

Two prototypes of the **Westminster** (two Napier Eland) are flying with a view to proving the characteristics of machines of this type in the heavy duty role. The makers state, "With a disposable load of some 14,000lb the Westminster meets the requirements for a large military transport helicopter able to carry heavy field equipment, atomic and nuclear weapons, and troops over stages of 150 n.m. or more."

The military potential of the **Rotodyne** (two Rolls-Royce Tyne) is summarized as follows:—

"It is vital for the Army to shed some of the present load on its supply lines. While the supply chain remains on the ground it is vulnerable, slow and wasteful of manpower. Let us see in more detail what this revolutionary aircraft can do for the soldier. Suppose that 500 tons of supplies—fuel, ammunition, food and so on—have to be brought up urgently to the forward area from base depots 100 miles to the rear. The speed of ordinary road transport would be slow, especially when the likelihood of obstacles and traffic congestion, and the need to move tactically under war conditions, are taken into account. A column of 166 three-ton lorries would be needed to move 500 tons of supplies. If the convoy averaged 10 miles an hour, and the road was as straight as the crow flies, it would take ten hours to reach the forward area. In those ten hours nine Rotodynes could do the whole job. Each Rotodyne would have time to make six round trips, carrying a load of 20,000lb each time, while the lorries were still on their way . . ."

Boeing DB-47E taking off with ALBM test vehicle

United States of America

Beech L-23 Seminole There are many versions of this aircraft in service with the US Army; most of the earlier models were direct military counterparts of the Twin Bonanza, but the L-23F is a derivative of the larger Queen Air and the RL-23D carries APS-85 all-weather surveillance radar in a large ventral fairing.

Beech T-34 Mentor Although no longer produced in the USA or Canada, this tandem-seat basic trainer is still being made in Japan and the Argentine. It is a standard *ab initio* trainer of the USAF, USN, Canada, Chile, Colombia, El Salvador, the Philippines and Turkey.

Bell HU-1 Iroquois Winner of a major design competition for a US Army utility helicopter, the basic HU-1A went into volume production in 1958 and probably about 100 have now been delivered. Powered by a Lycoming T53-L-1 free-turbine (derated to 770 h.p.), the Iroquois normally seats a single pilot and up to 10 passengers or 2,250lb of freight in the broad fuselage. Data are given below (also see *Flight* for May 27 last). On June 15 a mock-up board inspected the YHU-1D. Taking full advantage of the power potential of the T53, this version has a longer cabin which will accommodate 12 fully equipped troops; internal fuel capacity has also been increased. All Iroquois can carry a variety of weapons externally, including wire-guided missiles. Agusta, Bell's Italian licensee, plan to produce a Gnome-powered version.

Rotor diameter, 44ft; length (blades folded), 53ft; height, 11ft 3in; weight empty, 3,850lb; gross weight, 7,200lb; max speed, 142 m.p.h.; cruising speed, 115 m.p.h.; normal range, 186 miles.

Boeing B-47 Stratojet Boeing's plants in Seattle and Wichita, assisted by Douglas, Tulsa, and Lockheed, Marietta, manufactured 2,040 of these medium bombers for the USAF Strategic Air Command between 1951 and 1957. All are powered by six General Electric J47-GE-25A turbojets (7,200lb with water), have a crew of three and accommodate 20,000lb internally, or a GAM-63 or other missile externally. Medium Bomb wings are being re-equipped with the B-58 and B-47s are now often employed for special reconnaissance, tanking, weather missions, crew training and as a target drone.

Span, 116ft; length, 109ft 10in; height, 27ft 11in; wing area, 1,400 sq ft; weight empty, about 80,000lb; gross weight, 202,000lb (clean, 175,000lb); max speed, 630 m.p.h.; service ceiling, 42,000ft; range, 3,500 miles.

Boeing B-52 Stratofortress Asked to name the most important military aeroplane, most impartial Western observers would choose the B-52. It is at present responsible for delivery of approximately 80 per cent of the total thermonuclear yield forming the Western "deterrent," and is still considered to have the requisite ability to penetrate. The prototype flew in April 1952 and first delivery to the USAF Strategic Air Command was made in June 1955. Progressive improvements to both the aircraft and what it carries has maintained its vital competitive position, and two more major improvements have yet to come (fan engines and Sky Bolt).

Originally the B-52 was designed to fly 6,000 miles on its internal fuel at about M0.8 at 50,000ft while carrying a wide variety of weapons up to the largest thermonuclear warheads used in the West (probably about 20MT). The basic B-52A is powered by eight Pratt & Whitney J57-P-1W turbojets each of some 9,500lb thrust. Gross weight is 350,000lb, and some 30,000 Imp gal of fuel are contained in bag tanks in the fuselage and wings and in 833gal underwing tanks outboard of the outer engines. One of the many unusual features is the landing gear, comprising four steerable twin-wheel trucks under the fuselage and a small outrigger wheel near the wingtip. The pressurized nose accommodates a flight crew of five at two levels, and a gunner is located in a remote pressurized cell in the extreme tail to govern the operation of a radar-laid barbette of four 0.50in guns.

Only a few of the A Model were built (all at Seattle) and the first bulk deliveries were of the B-52B. Weighing 420,000lb and having a variety of improved types of J57 engine, this aircraft could be equipped with a large reconnaissance pod in the bomb bay. Minor improvements characterized the B-52C, built during 1956. The B-52D and E, made in both Seattle and Wichita, reverted to the single mission of bomber, as have all subsequent models. The B-52F, the last version made in Seattle, introduced the P-43W engine with a wet rating of 13,750lb. These engines were retained in the much-improved G model, manufactured only in Wichita. Data for this version are given at the end of this description. With a gross weight of 488,000lb, the G introduced a "wet" wing with integral tanks giving a great increase in fuel capacity and a range in excess of 9,000 miles. Inboard of the inner engines are pylons for a pair of GAM-77 Hound Dog missiles, and provision is made for carrying a GAM-72 Quail decoy drone internally. The fin has been cut down in height and the gunner has been re-located in the forward crew compartment.

Yet to come is the B-52H, which will include all the G improvements as well as Pratt & Whitney TF33-P-1 turbofan engines of 17,000lb thrust each, which will greatly improve field performance (even at 490,000lb), cruising speed, altitude, and—in particular—range. Although a photograph shows a fan-powered G model, the first H is not scheduled to fly until next year. Like the G already in service, the H will be equipped to carry GAM-87A Sky Bolt air launched ballistic missiles from the winter of 1964-5 onwards. A refinement in the H will be the addition of pods housing numerous forwards-firing rockets for dispensing anti-radar chaff.

A total of 704 of all versions has been programmed to equip the 14 SAC heavy-bomber wings authorized; of these, more than 500 must have been delivered. Funds have been allocated to provide additional spares and crew training for one-eighth of the force to maintain an airborne alert; such an alert could be flown from early next year, at an annual cost of $225m. In addition, all squadrons are being increasingly dispersed, and reaction time tightened up until one-third of the entire force could always be airborne in 15min.

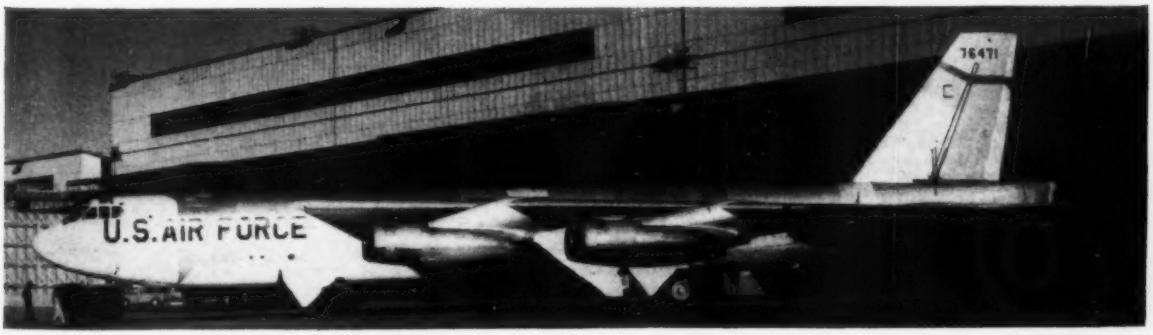
Pictures, pages 49 and 50.

Span, 185ft; length, 157ft 7in; height 40ft 9in; wing area, 4,000 sq ft; gross weight, 488,000lb; max speed, 650 m.p.h.; operational range, over 9,000 miles; operating altitude, nearly 60,000ft.

Boeing KC-135A Stratotanker In August 1954, a month after Boeing flew their privately financed 707 prototype, the USAF announced that a large number of military versions would be bought for use as tanker/transports for Strategic Air Command. The first came off the line at Renton in July 1956, and some 400 of the total of approximately 500 ordered have now been delivered. Essentially these aircraft resemble the 707-120 series of commercial transports. Powerplants are Pratt & Whitney J57-P-31 turbojets, each with a wet rating of 13,750lb.

In its primary mission as a SAC tanker 9,060 Imp gal of transfer fuel are located in cylindrical rigid tanks secured under the main floor and transferred to the bomber by means of a "flying boom" installation beneath the Ryan-built rear fuselage. The aircraft's own 14,488 gal of fuel are located in integral wing tanks. Since the refuelling equipment is entirely on the lower deck the main floor can be employed for a variety of

Boeing B-52G equipped with TF33 turbofans and superficially similar to B-52H



Boeing KC-135A refuelling B-52G

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transport purposes, normal limits being 80 passengers or 50,000lb of freight.

Span, 130ft 10in; length, 136ft 3in; height, 38ft 5in; wing area, 2,433 sq ft; gross weight, 297,000lb; max speed, over 600 m.p.h.; range with full load, over 4,000 miles; ceiling, over 35,000ft.

Boeing VC-137A The commercial 707 airliner differs from the KC-135 tanker in having a slightly fatter fuselage, with numerous small windows and no large freight doors. Three aircraft, essentially similar to the 707-120 (P & W JT3C-6 engines), have been bought for the global transport of the President and VIPs or priority cargo. They are fully furnished and equipped as an airborne headquarters.

Span, 130ft 10in; length, 144ft 6in; height, 38ft 5in; wing area, 2,533 sq ft; gross weight, 248,000lb; cruising speed, 525-575 m.p.h.; range, 4,460 miles; ceiling, over 40,000ft.

Cessna T-37 Standard primary jet trainer of the US Air Force, the T-37 won a design competition in 1954 and was first delivered to Air Training Command in 1956. A total of 416 T-37As was built, with twin Continental J69-T-9 turbojets (920lb), seating instructor and pupil side-by-side and equipped for all exercises not involving armament. These aircraft are being brought up to the standard of the current production T-37B (T-25 engines of 1,025lb thrust), data for which are given.

Span, 33ft 10in; length, 29ft 3in; height, 9ft 2in; wing area, 184 sq ft; weight empty, 4,056lb; gross weight, 6,600lb; internal fuel, 267 Imp gal; max speed, 408 m.p.h.; initial climb, 3,200ft/min; service ceiling, 39,200ft; range, 400 miles; stalling speed, 85 m.p.h.

Chance Vought F8U Crusader When the XF8U-1 flew on March 25, 1955, it ushered in the era of supersonic carrier operations, and its bold design is a superb solution to a challenging specification. Production deliveries of the F8U-1 started in March 1957. Powered by a Pratt & Whitney J57-P-4A (16,000lb with afterburner), these aircraft have a maximum speed of 1,150 m.p.h. (M1.75) and are characterized by an integral-tank wing with variable incidence, a hinged leading edge and folding outer panels. The short undercarriage folds into the fuselage, a refuelling probe retracts in the port side and armament comprises four 20mm guns and a belly pack housing 32 spin-stabilized rockets. A full description appeared in our May 24, 1958, issue. After these aircraft entered service they were modified to carry two Sidewinder missiles on the sides of the fuselage. A variant is the unarmed F8U-1P photo-reconnaissance machine. Total deliveries were about 500.

In December 1957 the company flew the first F8U-2, with the P-16 engine (17,000lb with afterburner), distinguished by a cropped vertical tail, the addition of large ventral fins and afterburner cooling-air scoops above the rear fuselage. Some 200 F8U-2s have now been delivered to both the Atlantic and Pacific fleets, and to the US Marine Corps. Last month the company delivered the first F8U-2N all-weather fighter. Powered by a P-20 engine (over 17,000lb with afterburner) the 2N is a far more effective weapon than the original Crusader, having an advanced angle-tracking radar and Vought-developed autopilot to enable it to perform a semi-automatic all-weather mission. A simple Y-bracket enables the 2N to carry two Sidewinders on each side. Data are given below.

Pictures, pages 45 and 46.

Span, 35ft 8in; length, 54ft 3in; height, 15ft 9in; weight empty, about 19,000lb; gross weight, about 30,000lb; max speed, 1,300 m.p.h. (M1.97); initial climb, over 17,000ft/min; service ceiling, about 60,000ft; range, 600 miles.

Convair B-58 Hustler Following a feasibility study for a supersonic bomber in 1951, Convair's Fort Worth plant was in August 1952 awarded a contract for the B-58 to be developed under the weapons system management concept. Major items and subsystems were delegated by Convair to 16 companies, and over 15,000 firms now support the overall programme. The only part not managed by Fort Worth is the powerplant, comprising four General Electric J79-GE-1 or -7 engines each rated at 15,000lb with afterburner.

Basically the B-58 follows Convair's previous tailless-delta formula, with pronounced conical camber and fully powered elevons. Most of the structure is fabricated from glass-fibre, light-alloy or stainless-steel honeycomb, in order to increase resistance to fatigue and high temperatures. Fundamental to the design is that all operational mission equipment is carried externally in an enormous pod slung beneath the fuselage and conforming to the overall area-rule profile. Notwithstanding the immense complexity of the aircraft it has a crew of only three—pilot, navigator/bombardier and defence-systems operator—whose work load is greatly reduced by the remarkable ASQ-42V bombing/navigation system. Unusual cooling systems are employed to combat kinetic heating throughout the aircraft, and in later versions all crew members will be housed in individual ejectable environmental capsules.

All B-58s bought by the USAF are for Strategic Air Command, since the Hustler's incredible ratio of fuel weight to gross weight gives it a range described as "intercontinental." Nevertheless, procurement has always been in modest quantities, resulting in high unit price; SAC is at present scheduled to receive only 116. One test squadron of 30 is at present operating from Carswell AFB, adjacent to the manufacturer's plant, and as each B-58 wing becomes operational SAC will deactivate two B-47 wings. The flexibility of the B-58 was demonstrated by a flight last October 7 from Carswell to Edwards at 700 m.p.h. never more than 500ft above the terrain, and a return at 50,000ft without refuelling. Other demonstrations have included 1,300 m.p.h. (M2) sustained for 1hr continuously in the course of a mission of much greater overall endurance, and a single flight covering over 11,000 miles in 18hr including two air refuellings.

The data below refer to the basic B-58A. Convair have long been investigating improved versions, some of which amount to complete redesigns. This month the TB-58 two-seat, dual-control trainer is being phased in to the SAC training programme preparatory to about 50hr B-58A flying for each pilot. The most advanced project is the B-58C, powered by four Pratt & Whitney J58s each rated at some 40,000lb with afterburner, and with a much improved airframe capable of cruising at M2.5. This variant is visualized by SAC as an interim strategic bomber. The B-58D has only two of the same engines and a new fuselage to equip it for its primary role of long-range intercepter. The reduced gross weight and other modifications would enable the D model to manœuvre at much higher load factors than those to which the B-58A was designed.

Picture, page 48.

Span, 56ft 10in; length, 96ft 9in; height, 31ft 5in; wing area, 1,542 sq ft; weight empty, approximately 50,000lb; gross weight, over 160,000lb; internal fuel, more than 12,500 Imp gal; max speed, over 1,300 m.p.h. (M2) at altitude; service ceiling, over 60,000ft.

Convair F-102 Delta Dagger After redesign in 1954-55 to confer supersonic dash ability, the 102A went into high-rate production at San Diego Plant 2 as the standard intercepter of USAF Air Defense Command. Fully described in our issue of April 19, 1957, it has a Pratt & Whitney J57-P-23 turbojet, rated at 16,000lb with afterburner, and is armed with six GAR-2, 3 or 4 Falcon air/air missiles (infra-red and radar, mixed) in an internal bay, the doors of the bay also having tubes for 24 spin-stabilized rockets. Total number built for ADC was 875, and these are in use in the USA, Alaska, Greenland, Germany and Japan.

Pictures, pages 44 and 46.

Span, 38ft 1½in; length, 68ft 3½in; height, 21ft 2in; gross weight, 27,000lb; max speed, 825 m.p.h. (M1.25) at 36,000ft.

Convair F-106 Delta Dart In the F-102 Convair knew they had an outstanding basic concept; but its operational effectiveness was hampered by its early inception. The F-102B was intended to rectify most major shortcomings in performance, and it eventually emerged as the completely redesigned F-106. Although of substantially the same size and shape as its predecessor, the 106 is a completely new aircraft. Apart from the redesigned vertical tail, the cropping back of the engine ducts, and the provision of fully-variable supersonic intakes, aerodynamic revisions are subtle; the fuselage profile departs from that of the 102 only slightly, and the wing not at all. Yet supersonic drag has been so decreased that, in conjunction with the greatly increased thrust of the Pratt & Whitney J75-P-17 (26,000lb with afterburner) the level speed has been approximately doubled. Proof of this is the fact that the F-106A has claimed the world's absolute speed record, at 1,525.95 m.p.h. (not yet ratified).

Operationally the 106 is considerably more lethal than its predecessor. Internal tankage is increased (underwing ferry tanks can be fitted), the guidance and fire-control is the sophisticated Hughes MA-1, which has a data link to the SAGE system and incorporates the Digitair computer for processing GCI commands into direct steering and weapon-control information, and the internal weapons bay can carry both Hughes Super Falcons and the Douglas MB-1 Genie atomic rocket.

The basic single-seat intercepter is the F-106A, which first flew on December 26, 1956 and is now in service with the USAF Air Defense Command throughout the USA. In contrast to the F-102, the two-seat

Chance Vought F8U-2N

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F-106B (which first flew on April 9, 1958) seats pilot and navigator, or instructor and pupil, in tandem.

Span, 38ft 3in; length, 70ft 8¾in; height, 20ft 3in; gross weight, approximately 35,000lb; max speed, more than 1,550 m.p.h. (M2.35); service ceiling, more than 50,000ft; combat radius, 500 miles.

Convair NX-2 The US Air Force began to study atomic-powered aircraft in 1948. Over $1,000m have now been spent on powerplant research, enabling the basic design of an NPB (nuclear-powered bomber) to be drawn up. Such a specification was first issued five years ago as WS-125A, but the decision to go ahead with an aeroplane has only recently been taken. Preliminary details of the NX-2 were released last month, and the announcement of the formal contract with Convair is imminent.

Optimum configuration is that of a high-subsonic canard, with two General Electric X-211 turbojets mounted on either side of a direct-cycle reactor forming an integral package (probably weighing about 200,000lb) which can be unbolted from the rear of the fuselage as a single "hot" unit. About 1,000lb of shielding will protect the crew in the extreme nose. Chief problems of the open-cycle engine are shielding and the high temperature needed, and ceramics are being intensively investigated to meet the latter requirement. It is likely that only one NX-2 will initially be built, and that it will be used as a test-bed both for the X-211 and for Pratt & Whitney's indirect-cycle powerplant. The sketch (overleaf) and data are provisional.

Span, about 220ft; length, about 140ft; weight empty, at least 450,000lb; gross weight, at least 500,000lb; operating speed, about M0.85 at 35,000ft; mission endurance, 125hr (about 750,000 miles); operating life between major overhauls not less than 1,000hr.

Convair TF-102A Although retaining the same armament and fire-control as the F-102A, the TF version has an entirely new nose accommodating two side-by-side with dual control. A total of 111 were built for use as combat-proficiency trainers. Data are generally the same as for the intercepter, except for the reduced length of 59ft 2in.

Douglas A3D Skywarrior Produced for the US Navy by the company's El Segundo Division, the Skywarrior joined the fleet on March 30, 1956, and is now widely used. The A3D-2 three-seat bomber is powered by two Pratt & Whitney J57-P-10 engines (12,400lb with water injection) and has a radar-laid twin-20mm tail barbette, and almost any USN airborne store can be carried in the bomb bay. Other versions in service are the A3D-2P (photographic), the -2Q (electronic countermeasures) and the -2T bomber-trainer; the Q and the T both have a pressurized fuselage, respectively seating seven and eight. The bomber version can carry a 1,083 Imp gal transfer-fuel tank.

Picture, page 45.

Span, 72ft 6in; length, 76ft 4in; height, 22ft 4in; wing area, 680 sq ft; weight empty, 39,760lb; gross weight, 73,000lb (maximum, 84,000lb); internal fuel, 3,651 Imp gal; max speed, 610 m.p.h.; service ceiling, 43,000ft; range, 2,000 miles.

Douglas A4D Skyhawk Designed at El Segundo as an exceptionally small and cleverly engineered carrier attack aircraft, the A4D-1 flew in June 1954, and deliveries to the US Navy started in October 1956. Powered by a Wright J65-W-4 (7,200lb), these aircraft have a wing made as a single integral tank from tip to tip and provided with large slats. There are four underwing pylons and shackles for a heavy store on the centreline, so that the main wheels have to retract into the wings in a forwards direction. The pilot has a lightweight ejector seat in the nose and further fuel is carried throughout the fuselage. Armament comprises two 20mm guns in the wing roots and 5,000lb of external stores, including Bullpup and Corvus. Minor improvements, particularly to the control system, characterize the A4D-2, which was fully described in our issue of March 7, 1958.

A photograph illustrates the current production A4D-2N, the first all-weather version (data below). Initially flown in 1958, the 2N has a J65-W-16A (7,700lb), and more advanced electronic equipment in the lengthened nose provides greatly improved all-weather and navigation capability. Pressure-fuelling is incorporated and, like the earlier versions, the 2N can carry a "buddy" refuelling pack and removable probe. Contracts amount to $232m, extending production through 1961.

Picture, page 45.

Span, 27ft 6in; length, 40ft 1½in; height, 15ft 2in; wing area, 260 sq ft; weight empty, 9,559lb; gross weight, 25,000lb (17,294lb clean); internal fuel, 666 Imp gal; max speed, 676 m.p.h. at sea level; range, 1,300 miles.

Douglas B-66 Destroyer Derived from the A3D, the B-66 was evolved by the company's Long Beach Division, initially as a three-seat bomber for the USAF Tactical Air Command. Its versatility is considerable and the following were the major versions produced; all have two Allison J71-A-11 or A-13 turbojets (10,200lb) and most have a GE electronic fire-control for a twin-20mm tail barbette. The B-66B carries 10,000lb of bombs internally. The RB-66B is a standard tactical reconnaissance aircraft and the RB-66C is a special-purpose (electronics and countermeasures) machine, with a crew of four. The final version was the WB-66D weather-reconnaissance aircraft. Data: B-66B.

Span, 72ft 6in; length, 75ft 2in; height, 23ft 7in; wing area, 780 sq ft; weight empty, 42,086lb; gross weight, 78,000lb (maximum, 83,000lb); internal fuel, 3,872 Imp gal; max speed, 620 m.p.h.; range, 1,750 miles.

Douglas C-133 Cargomaster A total of 50 of these huge cargo aircraft has been bought for the Military Air Transport Service, and the Douglas plant at Long Beach has delivered about 40. The first 35 are C-133As, with a gross weight of 275,000lb and 7,000 e.h.p. Pratt & Whitney T34-P-7W turboprops. A full description of these aircraft was published in our September 26, 1958, issue. The final 15 are of the improved C-133B version, with 7,500 e.h.p. engines, increased weight and structural changes to ease the loading of the Atlas ICBM. These aircraft are now capable of handling every Western missile. One of the earlier A versions has flown with a freight load of 117,900lb.

Span, 179ft 8in; length, 157ft 6½in; height, 48ft; wing area, 2,673 sq ft; weight empty, 116,191lb; gross weight, 286,000lb; internal fuel, 15,081 Imp gal; max speed, 359 m.p.h.; range, 4,000 miles with 55,000lb payload at 323 m.p.h.

Douglas F4D Skyray First deliveries of this bat-winged intercepter were made to the US Navy in 1956, and a modest number are now in service as fighter/bombers operating from carriers and, with the Marine Corps, from shore bases. Powered by a Pratt & Whitney J57-P-8B (15,000lb with afterburner), the Skyray has good performance at altitude. Armament comprises four 20mm guns in the wings, used in conjunction with Westinghouse radar fire-control; there are six wing pylons for up to 2,000lb of stores, usually Sidewinders and spin-stabilized rockets.

Span, 33ft 6in; length, 45ft 8¼in; height, 13ft; wing area, 557 sq ft; empty weight, 16,024lb; gross weight, 27,000lb; internal fuel, 533 Imp gal; max speed, 720 m.p.h.; at sea level; initial climb, 18,000ft/min; service ceiling, 55,000ft; range, 950 miles.

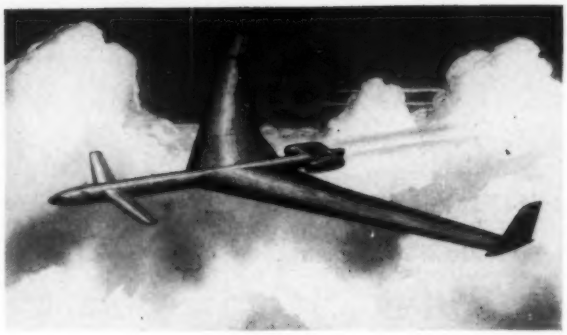
Convair F-106B Delta Dart

MILITARY AIRCRAFT OF THE WORLD . . .

Grumman A2F Intruder Providing an instructive comparison with the British NA.39, the A2F is a multi-purpose carrier-based aeroplane for the US Navy intended for operations at M0.9 at sea level. It thus has a strong and stiff structure, advanced control system and new forms of instrument presentation, including the DIANE digital integrated attack navigation system. The integrated display in the cockpit includes a pair of viewing screens which provide a visual representation of the ground and air in the quarter-hemisphere ahead and below. Details are classified, but the presentation is created by "the electronic transformation of information supplied by the modern sensory equipment." Acting upon information provided by this system, the pilot can preselect an automatic mission for a given target area which will thereafter be carried out virtually automatically, changes in plans being injected by the pilot.

Pilot and radar operator are seated side-by-side in the nose, with an excellent view. On either side of the belly are the two Pratt & Whitney J52-P-6 engines, each rated at 8,500lb, and a unique feature is that the jetpipe nozzles can be hydraulically tilted downwards through about 30° to provide optimum take-off and landing performance. Fuel occupies the entire centre fuselage. The wings fold upwards at about half the semi-span, and the main undercarriage units retract into the sides of the fuselage. There is no internal weapons bay, but any of a variety of stores may be accommodated beneath the centreline and on four wing pylons. Normal offensive load will probably be approximately 7,000lb; for example, an Intruder recently seen at Calverton had 2,000lb Mk 84 GP bombs on the centreline and inboard pylons and a pair of Bullpup missiles outboard. The Temco Corvus air-to-surface missile will be carried on the inboard pylons. Grumman have a cost-plus-incentive contract (the first administered by the Navy), amounting to just over $101m and covering eight test Intruders, four to be delivered this year and four in 1961.

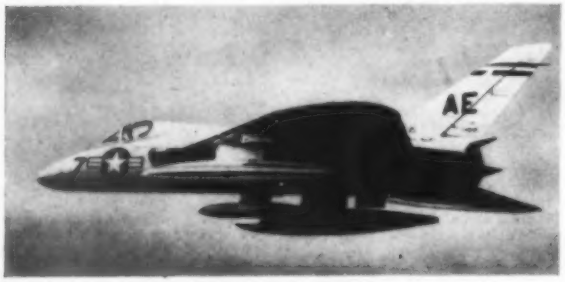
Span, approximately 45ft; length, approximately 40ft; weight empty, 24,000lb; gross weight, 54,000lb; max speed, 680 m.p.h. (M0.9); stalling speed, 92 m.p.h. with 40° flap, undercarriage down and full jet deflection, or 144 m.p.h. clean.



Convair NX-2

"Flight" copyright drawing

Douglas A4D-2N Skyhawk

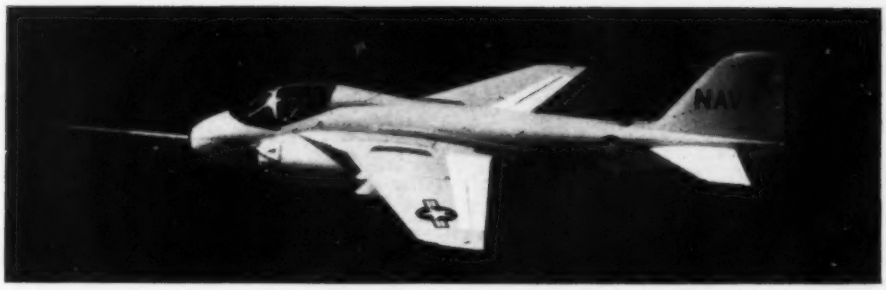


Douglas F4D-1 Skyray; below, Douglas B-66B Destroyer

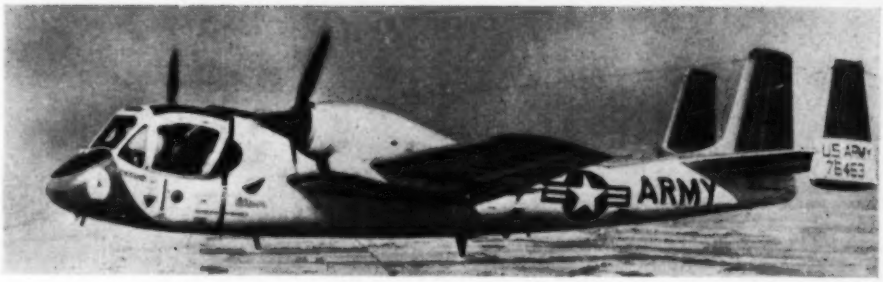
Grumman AO-1 Mohawk Unique among military aircraft, the Mohawk is an STOL observation machine for front-line use by the US Army. Powered by two Lycoming T53-L-3 turboprops (1,005 e.h.p.) it accommodates pilot and observer side-by-side in the nose; wing racks can carry camera pods, tanks and a variety of other stores; and internal equipment includes a KA-30 camera installation and side-looking radar. Most of the nine evaluation aircraft are in the engineering-test phase, and the 35 production machines so far ordered will enter service next year.

Span, 42ft; length, 41ft; height, 12ft 8in; wing area, 330 sq ft; weight empty, 7,772lb; gross weight, 10,088lb (12,800lb with maximum underwing load); max speed, 316 m.p.h.; initial climb, 3,000ft/min; service ceiling, 32.500ft; range, 460 miles (1,670 miles ferrying at 239 m.p.h. with two 125gal drop tanks); take-off to 50ft, 655ft; stalling speed, 63 m.p.h.; landing from 50ft, 776ft.

Grumman F11F Tiger When it first flew on July 30, 1954, the prototype Tiger exceeded Mach 1 on lower thrust than any previous aeroplane. A single-seat carrier fighter, it was area-ruled from the start and is an exceedingly small and efficient machine. Power is provided by a Wright J65-W-18 (10,500lb with afterburner) and fuel is housed in every feasible part of the airframe, including the fin. Landing gear retracts into the fuselage, and armament comprises four 20mm guns



Grumman A2F-1 Intruder



Grumman AO-1 Mohawk

and four wing pylons for tanks or Sidewinders. Deliveries to the Navy were completed last year; operational performance has been outstanding, and maintenance effort per flight hour has been roughly half that of other USN fighters.

A small number of tandem-seat F11F-1T trainers are in service, but Grumman failed to sell the G-98J Super Tiger (F11F-1F), which exceeded M2 on the thrust of a YJ79 with afterburner.

Span, 31ft 7½in; length, 40ft 10in; height, 12ft 9in; wing area, 250 sq ft; weight empty, 13,428lb; gross weight, 24,078lb (21,174lb clean); max speed, 890 m.p.h. (M1.35); service ceiling, 55,000ft; range, 700 miles.

Grumman S2F Tracker Standard US Navy carrier ASW aircraft, the Tracker is a four-seater powered by two Wright R-1820-82 Cyclones (1,525 h.p.), and is thus the last piston-engined combat machine in production. The weapon bay can accommodate a Mk 41 torpedo, mines or depth charges, and depth bombs or large-calibre rockets can be slung from six racks under the folding outer wings. Sonobuoys are ejected from the engine nacelles, MAD gear is carried in a retractable boom in the tail, the radome retracts into the rear fuselage and a searchlight is mounted beneath the starboard wing. The S2F-2 has a weapon bay bulged along the port side to house the Betty nuclear store, and production is now centred on the S2F-3, with span increased from 69ft 8in to the value given below and length increased from 42ft 3in. Over 700 S2Fs have been delivered to the USN, Holland, Italy and Japan, and 100 are being licence-built by D.H. Canada for the RCN.

Span, 72ft 7in; length, 43ft 6in; height, 16ft 7in; wing area, 506 sq ft; weight empty, about 16,700lb; gross weight, 24,000lb; max speed, 280 m.p.h.; service ceiling, 25,000ft; range 1,300 miles.

Grumman TF Trader Derived from the S2F, the TF-1 has a swollen fuselage accommodating 9 passengers or priority cargo; alternatively it can be equipped for special training purposes.

Grumman WF Tracer Standard US Navy carrier-based early-warning aircraft, the WF-2 is essentially a TF-1 redesigned to carry an AEW radar in a vast saucer-like radome above the fuselage. Major modifications include an entirely new tail with twin fins, and revised wing folding. Two pilots sit in the nose and two radar operators in the main cabin; in the air one pilot normally moves aft to a tactical director's seat.

Span, 72ft 4in; length, 45ft 4in; height, 16ft 10in; wing area, 506 sq ft; weight empty, 21,024lb; gross weight, 26,594lb.

Grumman W2F Winner of last year's competition for the future US Navy carrier-based early warner, the W2F will be designed for this function from the outset. Powered by two Allison T56 turboprops (4,050 e.h.p. with water injection) it will have a crew of five in a pressurized fuselage and will carry its radar in a large overhead "saucer."

Kaman H-43 Huskie Following upon the piston-engined H-43A and HOK series, the H-43B is the standard US Air Force crash-rescue helicopter. With intermeshing rotors driven by a Lycoming T53-L-1 free-turbine (825 s.h.p.), it has accommodation for a crew of two and eight passengers.

Kaman HU2K Seasprite A new utility helicopter for the US Navy, the Seasprite is powered by a General Electric T58-GE-6 free turbine (1,025 s.h.p.) and has a retractable undercarriage. Automatic stabilization and DR navigation equipment is provided to enable it to be flown hands-off during rescue or anti-submarine operations. With a crew of two, nine passengers or 4,000lb of freight can be carried.

Rotor diameter, 44ft; length with blades folded, 52ft 2in; height, 12ft 5in; weight empty, 5,052lb; gross weight, 9,152lb.

Lockheed C-130 Hercules A total of 231 C-130As had been delivered when production ceased a year ago; chief user is the USAF Tactical

Douglas C-133A Cargomaster

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Air Command, but 12 were bought by the RAAF. Powered by four Allison T56-A-1A turboprops (3,750 e.h.p.) these pressurized aircraft can carry 28,000lb of freight or 92 troops, and are equipped for heavy dropping. Off-shoots are the RC-130A (16 ordered) equipped for reconnaissance, the C-130D (12 ordered) with wheel/ski undercarriage, and the GC-130A (2) which can act as mother ship to four Firebee targets.

Production is now centred on the C-130B, with A-7A engines (4,050 e.h.p.). In addition to the data given below, the maximum payload of this version is 36,700lb; the airframe is strengthened and fuel capacity increased. At present 53 are being built for the USAF, the GV-1 is an assault transport and tanker of the US Marine Corps, and five were delivered to Indonesia. A blown-flap version, with auxiliary podded gas turbines, has demonstrated extraordinary field performance.

Span, 132ft 7in; length, 97ft 8in; height, 38ft 9in; wing area 1,745 *sq ft; weight empty,* 58,700*lb; gross weight,* 135,000*lb; internal fuel,* 5,745 *Imp gal; max cruise speed,* 370 *m.p.h.; initial climb,* 2,450*ft/min; range,* 4,000 *miles at* 350 *m.p.h. with* 22,700*lb cargo; take-off over* 50*ft,* 4,200*ft; landing ground roll,* 1,400*ft.*

Grumman S2F-3 Tracker

Lockheed EC-121/WV-2 Warning Star Derived from the Super Constellation, the USAF EC-121D and Navy WV-2E were the last of a series of early warners designed for extended patrol off the eastern and northern seaboard of North America. Powered by four Wright Turbo-Compounds (3,500 h.p.) they have a crew of 31 and carry the main scanner in a saucer-like dish above the fuselage.

Lockheed F-104 Starfighter From 1952 Lockheed's California Division attempted to produce a supersonic day "air superiority" fighter for the USAF having the highest possible performance and minimum cost. Korea had shown an urgent need for a smaller and simpler aircraft with better equipment, greater combat performance, and designed from the outset as part of a weapon system. Production of two prototypes was authorized in March 1953, quantity production was assured in June 1954 and the first F-104A flew in February 1956. Aptly described as "a missile with a man in it" the 104A has earned itself a mixed reputation since it entered service with Air Defense Command in February 1958. Undoubtedly the "hottest" combat aeroplane, it has proved itself a flashing performer, but during its first year in service the number of aircraft written off, frequently with the loss of the pilot, was high.

Aerodynamic design is bold. The wing has a t/c ratio of but 3.36 per cent, a sharp, drooping leading edge, and simple flaps. Everything is carried in the fuselage, including the General Electric J79-GE-3A engine (15,000lb with afterburner), airflow around which provides additional thrust through the ejector nozzle and a means of matching the swallowing capacity of the fixed-geometry intakes to engine demands. All internal fuel is stored in the fuselage; normal capacity is approximately 900 Imp gal. The T-171 Vulcan 20mm six-barrel installation is fed by a single belt, cases being stored in a box and links being dumped overboard. All control surfaces are fully boosted, and in the absence of hydraulic pressure are locked in the neutral position. No autopilot is fitted, but on the 104A the manual rudder is provided with a yaw damper. Small vanes on the forward fuselage sense angle of attack, and with the onset of pitch-up shake the control column and (in the absence of remedial action) push the stick forward. Most current 104s have a downward-ejection seat, the canopy hinging sideways for entry and normal exit.

Most 104As have now been withdrawn and last year the 104 was removed from service with Air Defense Command entirely. Its place in production was taken by the tandem-seat 104B multi-purpose combat-proficiency trainer, with reduced internal fuel and a fully powered rudder (without separate damping surface) of increased area, and the 104C, which incorporates many detail refinements. Most important of the latter are the change to the GE-7 engine (16,000lb with afterburner), the incorporation of compressor-bleed flap blowing, a refuelling probe and provision for carrying out ground-attack missions. The two-seat Tactical Air Command counterpart is the 104D. The Japanese Government has adopted the 104C, and 180 F-104C/J and 20 F-104D/J aircraft

Grumman F11F-1 Tigers

are to be licence-built by Mitsubishi in Japan during the next five years.

Next sub-type is the F-104D for Tactical Air Command, a tandem-seat trainer and local-defence aircraft developed from the 104C. Some 40 Lockheed-built Ds are to be shared by Japan and the Netherlands. Lockheed will build 30 similar aircraft for Western Germany as the F-104F; Martin-Baker upward-ejection seats will be fitted, and equipment will generally parallel that of the "European" 104G.

The G model is by far the most important of the family, and it represents a synthesis of all the latest improvements to produce the optimum multi-mission aircraft. A single-seater, it has a strengthened airframe to enable external loads to be carried at high speeds and low altitudes and to permit the structure to withstand the increased manœuvrability (a one-third reduction in turning radius at 5,000ft) provided by the addition of manœuvring flaps. Major changes include the incorporation of the NASARR air-to-air and air-to-surface radar fire-control, inertial navigator, air-data and toss-bombing computers, director gunsight and infra-red sight, Tacan, improved UHF, data-link time division set, position-and-homing indicator, electric intake ice protection, anti-skid brakes, fuselage pylons for Sidewinders, a retracting ventral rail for large rockets, additional wing pylons, a manœuvring autopilot, larger braking parachute and 100gal optional tanks in place of the gun and its ammunition. At present 66 will be made for Germany by Lockheed's California Division, and a further 210 will be made by the South German consortium, 364 by the North German group jointly with Holland and Belgium, and a further quantity is likely to be constructed in Europe for use by Italy and other countries. Engines will be made by BMW and FN. Canada has adopted the model under the designation CF-104, and 200 are to be manufactured by Canadair as the CL-90. Mention should also be made of the QF-104 drone, most of which are conversions of 104As.

Span, 21*ft* 11*in; length,* 54*ft* 9*in; height,* 13*ft* 6*in; wing area,* 179 *sq ft; weight empty,* 13,800*lb* (*two-seaters,* 13,200)*; gross weight,* 17,000*lb* (104*A*), 20,500*lb* (104*C*), *or* 27,000*lb* (104*G maximum permissible*)*; max speed, about* 1,600 *m.p.h.* (*M*2.36)*; service ceiling,* 60,000*ft.*

Lockheed P2V Neptune Approximately 1,000 Neptunes have been delivered to the US Navy and to Argentina, Australia, Canada, France, Italy, Japan and the Netherlands, and Japan is making a small batch. The current P2V-7 is powered by two Wright Turbo-Compound engines (3,500 h.p.) and two Westinghouse J34-WE-36 turbojets (3,400lb) and carries a crew of nine. Armament comprises twin 20mm guns in the dorsal turret, 8,000lb of assorted stores internally and 16 rockets under the wings. The APS-20 radar is housed in a fixed radome, additional electronics and a searchlight are carried in the forward portions of the tip tanks and MAD gear is housed in the extreme tail. In addition to the aircraft's usual functions as an ocean patroller many are employed as parent to Firebee drones, and a few are used as RB-69 radio trainers by the USAF.

Span, 103*ft* 10*in; length,* 91*ft* 8*in; height,* 29*ft* 4*in; wing area,* 1,000 *sq ft; weight empty,* 49,935*lb; gross weight,* 79,895*lb; max speed,* 356 *m.p.h.; initial climb* 2,527*ft/min; service ceiling,* 22,000*ft; range,* 3,850 *miles.*

Lockheed P3V Electra Winner of a Neptune-replacement competition early in 1958, the P3V-1 is an ASW ocean patroller based on the Electra airliner. Powered by four Allison T56-A-10W (4,500 e.h.p. with water injection) it has a pressurized fuselage for a crew of ten. An internal weapons bay ahead of the wing and external pylons can carry some 15,000lb of stores, radar is housed in the nose and beneath the fuselage and MAD gear in a tail sting. Cruising on the outboard engines only it is calculated that 370,000 sq miles could be searched in a single mission. Deliveries start next year.

Span, 99*ft; length,* 113*ft* 7*in; height,* 33*ft* 1*in; wing area,* 1,300 *sq ft; gross weight,* 125,000*lb; max speed, over* 450 *m.p.h.*

Lockheed T2V Seastar Final descendant of the original F-80/T-33 family, 271 T2V-1s are serving as combat and carrier trainers with the US Navy. Powered by an Allison J33-A-24 (6,100lb) the Seastar seats the instructor behind and above the pupil, and has blown flaps.

Lockheed U-2 Although originally designed by Lockheed's California Division as a research test-bed, and used by NASA for global exploration of the upper atmosphere, the unmatched altitude performance of the U-2 led to its selection for unauthorized penetrations of Soviet air space as a routine task. At least 25 were delivered; six have been lost in accidents and a famous specimen was destroyed near Sverdlovsk on May 1. Early versions were powered by Pratt & Whitney J57s, but the "espionage" variants have the J75-P-13 (about 17,000lb) with extended compressor blading. Equipment includes MIT inertial guidance, Lear

A-10 autopilot and a wide range of visual, infra-red and electronic reconnaissance systems. Further details were given in our issues from May 13 to May 27 last.

Span, 80ft; length, 49ft 7in; gross weight, 15,850lb with 653 Imp. gal fuel or 17,270lb with pinion tanks and 828gal; max speed, 500 m.p.h.; cruising speed, 460 m.p.h. at 90,000ft; range, with pinion tanks, 2,600 miles (can be extended by gliding).

Martin B-57 A total of 403 of these American versions of the Canberra were manufactured, the majority now being B-57E target tugs (55,000lb gross, twin 7,200lb Wright J65-W-5); some B-57Bs serve with the air forces of Pakistan and Nationalist China. Small numbers of RB-57Ds were built for special reconnaissance missions at extreme altitude; powered by two Pratt & Whitney J57-P-5s (10,500lb) these tandem-seat aircraft have a span increased to 109ft 6in and carry a comprehensive camera installation.

Martin P5M Marlin Although the first P5M-1s joined the US Navy ten years ago, the latest P5M-2 is still in production for the USN and France. Powered by two Wright Turbo-Compounds (3,400 h.p.) this seven-seat flying-boat can carry 12,000lb of stores and has comprehensive radar and MAD gear.

McDonnell F-101 Voodoo From the original XF-88 of 1948 was developed the much more powerful F-101, powered by two Pratt and Whitney J57 engines, the first of which flew on September 28, 1954. First production version was the F-101A single-seat fighter for the USAF Tactical Air Command. On two J57-F-13s (14,000lb with afterburner) one of these aircraft established a speed record at 1,207 m.p.h.; most have now been converted into RF-101As by the fitting of a lengthened camera-filled nose. The F-101C is strengthened to carry a nuclear store on the centreline between two 375 Imp gal drop tanks at low level. The reconnaissance versions are unarmed, but the A and C carry four 20mm guns. There are no wing pylons.

Most important current version is the F-101B all-weather intercepter of Air Defense Command. Stated to have a greater combination of speed and range than any other ADC aircraft, it seats a pilot and radar observer in tandem and has a complete search radar and fire-control system. No guns are carried, but provision is made for three Super Falcon homing missiles or a pair of MB-1 Genie nuclear rockets on a weapon door beneath the rear cockpit. Other features peculiar to the B Voodoo are uprated J57-F-55 engines (17,000lb with afterburner), a refuelling probe and a braking parachute.

Span, 39ft 8in; length, 67ft 4½in (RF versions 69ft 3in); height, 18ft; wing area, 365 sq ft; gross weight, approximately 48,000lb; max speed, 1,250 m.p.h. (M1.9) at height; initial climb, about 14,000ft/min; service ceiling, over 55,000ft; range, 2,600 to 3,000 miles.

McDonnell F3H Demon After the debacle of the J40-powered F3H-1, the F3H-2 series, with the Allison J71-A-2 (14,000lb with afterburner), is serving with both the Atlantic and Pacific fleets of the US Navy. Although assorted stores up to about 5,000lb can be carried, the usual armament is four 20mm guns and Sidewinders (F3H-2N night and AW fighter) or Sparrow 3s (F3H-2M day fighter).

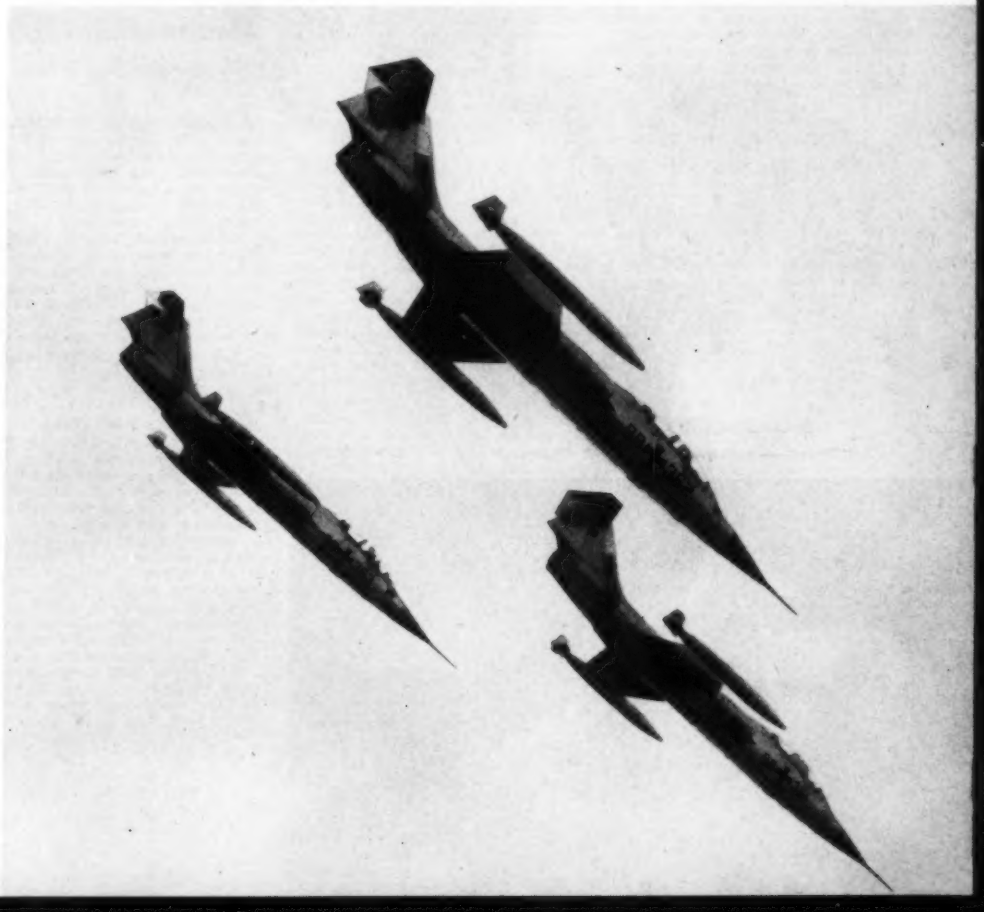
Picture, page 46.

Span, 35ft 4in; length, 58ft 11in; height, 14ft 7in; wing area, 519 sq ft; weight empty, 22,133lb; gross weight, 33,900lb; max speed, about 720 m.p.h. (M1) at 12,000ft.

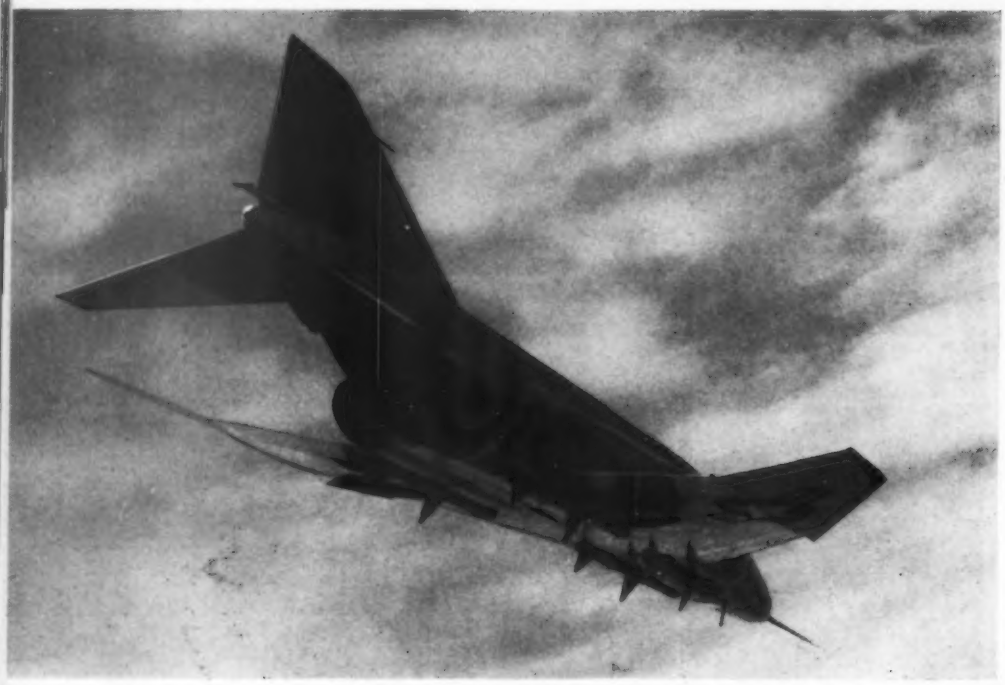
McDonnell F4H Phantom II Produced to meet a US Navy requirement for a supersonic all-weather fighter, the Phantom II was chosen over a competitor owing to the fact that it has two engines and a crew of two. The former are General Electric J79-GE-8s (16,500lb with

Lockheed P3V-1 Electra

McDonnell F-101B Voodoo



Lockheed F-104F two-seaters for the Luftwaffe



MILITARY AIRCRAFT OF THE WORLD . . .

McDonnell F4H-1 Phantom II

afterburner) and the crew comprise pilot and navigator seated in tandem. Internal fuel capacity is greater than that in any other fighter currently flying, and the structure and aerodynamic design are exceedingly bold. Approach speed is held to 144 m.p.h. by drooping the leading edge 30° (inboard) and 60° (outboard) and blowing bleed air over both these surfaces and the trailing-edge flaps.

Normal intercepter load is four Sparrow 3 missiles partially submerged in the underside of the fuselage and four Sidewinders on wing racks. A complete radar search and fire-control system is carried, and the final attack is made partly automatically, closing within five miles of the target. Three-axis stability augmentation is provided, and the aircraft can operate from carriers with its full weapon load and a belly tank of 500 Imp gal capacity. A refuelling probe and "buddy" pack are provided. Carrier trials are now being flown by the 23 development aircraft (with the less powerful GE-2A engines), and carrier service is expected next year.

Span, 38ft 5in; length, 56ft; gross weight, over 40,000lb; max speed, approximately 1,700 m.p.h. (M2.57) at height; service ceiling, over 70,000ft; range, over 1,500 miles.

North American A3J Vigilante Designed and manufactured by North American's Columbus Division, the A3J is to be the standard attack bomber of the US Navy. It has matured as a nuclear delivery system of great versatility and outstanding potential. It combines the ability to carry virtually any store weighing less than 6,000lb and of taking off from a carrier or modest runway, and completing any type of mission, at any altitude and in the most adverse weather conditions. It can also fulfil all normal reconnaissance and intelligence functions.

In the slender forward fuselage are located a large radar navigation and weapon-delivery system, pilot and navigator in tandem, and most of the systems. Ahead of the high-mounted wing are the fully variable intakes serving the two General Electric J79-GE-2 or -4 engines each rated at 15,000lb with afterburner. The wing is swept and very thin, yet it is arranged to fold and has a hinged leading edge, blown flaps and

North American T2J-1 Buckeye

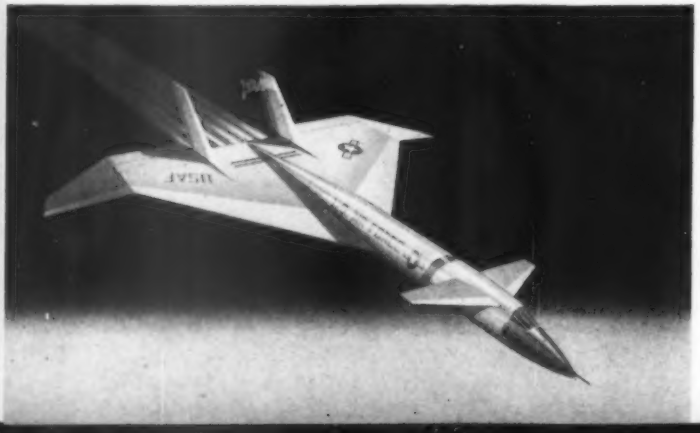
spoiler/deflectors in place of ailerons. All three undercarriage units retract into the fuselage and the considerable internal fuel capacity occupies a large part of the centre fuselage and integral wing panels. Underwing tanks can be carried, and provision is made for a retractable probe and ram-driven pod for refuelling other aircraft. Structurally the aircraft is exceedingly advanced and it incorporates many unusual materials and techniques.

NAA handled the automatic flight-control system, including holds for Mach and bank angle and automatic LABS. All units of the electronics systems are modular blocks. Weapons are stored in an axial bay which occupies the entire space between the powerplants, stores being ejected pneumatically from between the afterburner nozzles; there are no bomb doors and no problems of stores separation at supersonic speed. About 15 have so far flown, and the unit price is just under £2m.

Span, 53ft; length, 73ft; height, 20ft; gross weight, approximately 50,000lb; max speed, about 1,350 m.p.h. (M2.1); service ceiling, 70,000ft; range, 2,300 miles.

North American B-70 Valkyrie

"Flight" copyright drawing

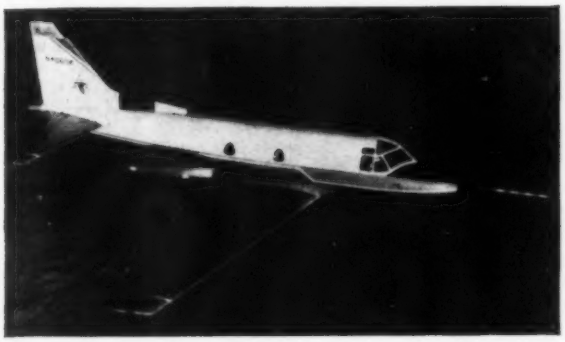


North American B-70 Valkyrie Originating in the WS-110A CPB (chemically-propelled bomber) specification, a contract for the B-70 was awarded to the company's Los Angeles Division on December 23, 1957. It called for an intercontinental bomber for the USAF Strategic Air Command, capable of cruising continuously at more than 2,000 m.p.h. at above 70,000ft. For this work NAA marshalled the largest team ever assigned to one aircraft.

Powered by six General Electric J93-GE-3 turbojets (over 30,000lb with afterburner), the B-70A is to be a canard, with downward-hinging outer wings and a structure fabricated in stainless steel and other heat-resistant materials. Major systems included air induction control (Hamilton Standard), stabilized platform (Sperry), secondary power (Sundstrand), stellar-inertial bomb/navigation (IBM), defence (Westinghouse), air data (AiResearch), and alert pod (Beech). The crew of four will sit in environmental capsules.

Earlier this year it was decided to cut the programme drastically. Only two prototypes were to be ordered, and these were to be gutted of their combat equipment and employed as research aircraft. NAA pulled back most of the major sub-contracts and maintained construction of the two prototypes to a schedule calling for a first flight in 1963. Last month the (Fiscal 1961) defence budget restored $285m, which

North American A3J-1 Vigilante



North American Sabreliner prototype

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will enable most of the combat systems to continue to the original schedule.

Span, about 120ft; length, about 200ft; gross weight, about 600,000lb; cruising speed, over 2,000 m.p.h. (M3.05) at over 70,000ft; range, more than 7,000 miles on conventional JP-6 fuel.

North American F-86 Sabre A total of 6,232 Sabres was built by NAA, plus 1,815 by Canadair (Orenda-powered from No 791), 96 Avon-powered CA-27s in Australia, and 221 F-86K all-weather fighters built by Fiat for NATO. In Japan, Mitsubishi are delivering 300 F-86F day fighter/bombers. Total was thus 8,664.

North American F-100 Super Sabre When it entered service in September 1954 the F-100A was the only supersonic combat aeroplane in the world. It was designed around a single Pratt & Whitney J57, rated at 15,000lb with afterburner, as a single-seat day fighter/bomber for the USAF. Unusual features include full-span slats, inboard ailerons (no flaps) and a nose intake. After a few As had been delivered to Tactical Air Command they were replaced by the F-100C, equipped with four underwing pylons, a refuelling probe, and having the 16,000lb J57-F-21 engine. The D model has an autopilot, and the last production version, the F-100F, is a versatile tandem two-seater with only two 20mm guns (instead of four) and ILS. Total production of F-100s was 2,294, and the type is used in all USAF theatres and by the French Air Force.

Pictures, pages 45 and 46.

Span, 38ft (F-100F, 39ft); length, 47ft (54ft 3in including pitot boom; basic length of F-100F, 50ft); height, 16ft; wing area, 385 sq ft; weight empty, 16,000lb and over (F-100F, 21,346lb); gross weight, 27,000lb and over (F-100F, 34,235lb); internal fuel, 987 Imp gal; max speed, about 870 m.p.h. (M1.32) at height; range, 1,100 miles; initial climb, 20,000ft/min clean, or about 15,000ft/min with 7,500lb external stores.

North American FJ Fury Discounting the original FJ-1 of 1946, the first Fury was the FJ-2, a navalized F-86E. The J65-powered FJ-3 followed, and the final types were the FJ-4 and 4B, the 4B (7,700lb Wright J65-W-16A) being a very capable carrier-based fighter/bomber with six pylons, four 20mm guns, toss-bombing computer, refuelling probe, and provision for carrying such stores as Gatling-gun pods and Bullpups. The last was delivered last November and total production was 1,148. Data refer to the 4B.

Span, 39ft 1in; length, 37ft 6in; height, 13ft 11in; wing area, 338 sq ft; weight empty, 12,000lb; gross weight, 26,000lb (19,900 clean); max speed 687 m.p.h. (M0.97) at 7,500ft; initial climb, 7,500ft/min; service ceiling, 45,000ft; ferrying range, 2,700 miles.

North American T-39 Sabreliner Developed at company expense to meet the USAF UTX specification, the Sabreliner was last year rewarded by a production contract as the T-39. Powered by two Pratt & Whitney J60 turbojets, the aircraft is to be used by Air Training Command for six jet-training missions, utility and staff transport, tactical mission support, GCI target, target tug, chase plane and ECM or radar trainer. Two pilots sit in front and the pressurized cabin will seat eight. The current budget buys 42, and about the same number may be purchased annually.

Span, 44ft 5in; length 43ft 8in; height, 15ft 11in; wing area, 342 sq ft; weight empty, 9,199lb; gross weight, 15,330lb; internal fuel, 708 Imp gal; max speed, 575 m.p.h.; initial climb, 5,550ft/min; service ceiling, about 47,000ft; range, 1,400 miles; stalling speed, 87 m.p.h.

North American T2J Buckeye To be the Navy's standard basic trainer, the T2J-1 is a tandem-seater powered by a Westinghouse J34-WE-48 (3,400lb) mounted in the belly. Full carrier equipment is carried, an 83 Imp gal tank can be attached at each wingtip and pylons can carry a variety of gun, rocket or store armament. All maintenance can be done while standing on the ground, flight handling "is that of fleet-type airplanes" and both occupants have rocket-boosted seats which can eject at ground level. Buckeyes are in use at Sherman Field, Florida, and will shortly train all Navy and Marine pilots at Pensacola.

Span, 35ft 11in; length, 38ft 8½in; height, 14ft 10in; wing area, 255 sq ft; weight empty, 6,893lb; gross weight, 11,373lb (9,507lb clean); internal fuel, 317 Imp gal; max speed, 492 m.p.h.; initial climb, 5,000ft/min; service ceiling, over 40,000ft; stalling speed, 79 m.p.h.

Northrop N-156F Freedom Fighter Although it has so far failed to be chosen as standard equipment by any of the many countries to which it has been offered, the N-156F is a design of singular ingenuity deserving greater success than it has achieved to date. Its history and characteristics were outlined in detail in our January 8 issue. It was then pointed out that the project started as a company venture in May 1958, basing the design on that of the T-38 trainer. Although the USAF never expressed interest in the aircraft, the Department of Defense allocated almost $50m for the development of the aircraft and its twin General Electric J85-GE-5 engines (each rated at 3,850lb with afterburner), sufficient for three aircraft and a test airframe. The first of these aircraft, bearing a USAF serial number, flew a year ago and all three are now being evaluated at Edwards AFB.

Internal fuel capacity is approximately 500 Imp gal, all in the fuselage, and standard equipment includes a lightweight ejection seat, fully powered controls, UHF, Tacan, IFF, radar-ranging, infra-red search equipment and a bomb-director system for use during LABS missions. Stores can be accommodated on the centreline, and at wing stations 83, 111 and at the tips. Almost any store with a weight of 2,000lb or less can be accommodated, and provision is made for carrying Sparrow 3, Sidewinder, Falcon and Bullpup missiles. In a final effort to achieve NATO acceptance, Northrop have evolved a weapon system under the name of Rapiere around the basic N-156F aircraft. The Hughes TARAN radar fire-control and navigation system is matched with any of the current series of supersonic air-to-air and air-to-surface missiles of Nord-Aviation. With the TARAN, the AA/AS.25 would be logical, and the N-156F can also carry the 1,125lb AS.30 air-to-surface weapon, which is large enough to have a nuclear warhead.

Picture, page 47.

Span, 25ft 3in; length, 45ft 1in; height, 13ft 1in; wing area, 171 sq ft; weight empty, 7,596lb; gross weight, 12,190 to 16,300lb depending on external load; max speed, about 1,000 m.p.h. (M1.5) at 36,000ft, rising to over M2 with later improvements; range up to 2,000 miles depending on load; service ceiling, 52,000ft; field length, 2,000 to 4,000ft depending on load.

Northrop T-38 Talon During 1955 the US Air Force issued a general operational requirement for a supersonic basic trainer, and in June 1956 Northrop were awarded a contract for 14 T-38 airframes. The first of these flew in April 1958, and in December of that year the company received a production contract for Air Training Command. It is likely that more than 500 of these aircraft will be bought for ATC during the

Republic F-105D Thunderchief

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coming six years. Annual funding is likely to keep production running at about 80 aircraft annually.

New and uncompromised design has made the Talon a truly outstanding aeroplane, particularly in its modest demands on ground support and skilled manpower. Powerplants are twin General Electric J85-5 turbojets each rated at 3,850lb with afterburner. Instructor and pupil sit in tandem ejector seats and can both operate the fully powered control system with two-axis stability augmentation. Normal equipment includes UHF, Tacan, IFF and ILS, but no provision is made for any form of armament.

Span, 25ft 3in; length, 44ft 2in; height, 12ft 10in; wing area 170 sq ft; weight empty, 7,200lb; gross weight, 11,650lb; internal fuel, 500 Imp gal; max speed, 840 m.p.h. (M1.24) at 35,000ft; range, 1,200 miles; initial climb at gross weight, 28,500ft/min; service ceiling, 55,000ft; take-off ground run at max weight, 2,700ft; stalling speed at 8,450lb, 134 m.p.h.

Republic F-105 Thunderchief Winner of the WS-300A competition for a single-seat tactical fighter/bomber in 1955, the F-105 went into volume production for USAF Tactical Air Command in the autumn of 1958. First production version was the F-105B, fully described in our issue of June 12, 1959. Basically it carries twice the offensive load of the company's earlier F-84F, at more than twice the speed over approximately 50 per cent greater range and with more competent operational equipment to ensure a successful mission in any weather. It is undoubtedly the most complicated and versatile aeroplane ever put in the charge of a single pilot. All Thunderchiefs are powered by a single Pratt & Whitney J75 turbojet with afterburner, the 105B having the P-5 version with a wet afterburning rating of 26,500lb. The engine is fed through unique supersonic wing-root intakes, and the afterburner nozzle is located in the centre of four petal airbrakes, which when closed form a convergent/divergent ejector nozzle. The fully powered controls include a low-mounted slab tail, hinged and cambered leading edge, large flaps, small ailerons and wing spoilers. Fuel is housed in fuselage cells and integral wing tanks, the capacity being more than 2,000gal.

Sikorsky HUS-1 with Bullpup missile; below TT-1 Pinto

Radar ranging controls the M-61 Vulcan six-barrelled 20mm gun. In the F-105B the full potential 6,000rds/min of this gun was realized by Republic's dual feed system involving a pair of belts. An internal weapons bay can accommodate up to 4,000lb of a wide range of stores, and external pylons are provided on the centreline and at two points on each wing. The 105B first flew on May 26, 1956, and has normal and maximum gross weights of 34,000 and 46,000lb respectively. Last December a 105B flew a 100km closed circuit at 1,216 m.p.h., pulling 2.5g continuously at 38,000ft at 9.9 miles radius around 12 pylons.

Announced missions are interdiction, offensive sweeps, escort, interception, offensive reconnaissance, and electronic countermeasures. A vast increase in operational effectiveness characterizes the current production F-105D (J76-P-19W), data for which are given below, which first flew on June 9, 1959, and which is now in accelerated production with a backlog of some $400m, assuring manufacture until 1962. Although still a single-seater, the D model is a true all-weather aircraft, its lengthened nose accommodating the all-purpose NASARR monopulse radar system integrated with the fire-control and flight-control systems. NASARR provides all functions for missions at all levels, including air search, automatic tracking, ground-mapping, and terrain avoidance. Upon demand, a digital computer, in conjunction with other systems, will automatically govern weapon delivery, either from altitude or by a LABS manœuvre. To assist installation of the additional electronics, 16 cu ft were saved by developing a linkless feed system for the M-61 gun, ammunition being stored in a drum and fed by an endless-belt conveyor, another conveyor returning the empties back into the drum.

As was outlined in detail in our full description of the Thunderchief on June 12, 1959, the 105D equipment includes the ASG-19 fire-control produced by the Autonetics Division of North American Aviation and the APN-105 Doppler radar made by LFE which includes an Earth-rate directional reference. With the production F-106 intercepter, this aircraft is the first to go into service with the new WADC Phase II instrument panel which incorporates vertical-scale flight instruments. It is by such improvements that it has been possible to dispense with a second crew-member, and considerable sums were saved by the decision not to procure the tandem-seat F-105C and E.

Republic have tried to have the F-105D accepted by NATO, and even manufactured in Europe with a British engine, but the inevitable high unit price is a handicap. A VTOL development is being studied.

Picture, page 44.

Span, 34ft 11in; length, 64ft 3in; height, 19ft 8in; wing area, 385 sq ft; weight empty, 27,500lb; gross weight, 52,000lb (maximum) or 35,200lb clean; max speed, over 1,350 m.p.h. (M2.1); initial climb, approximately 35,000ft/min; service ceiling, over 50,000ft; range, over 2,000 miles.

Sikorsky S-56 series Powered by twin Pratt & Whitney R-2800-54 piston engines (1,900 h.p.) the S-56 has a five-blade main rotor, retractable main gear and clamshell nose doors. The type can seat 26 troops and once lifted a load of 13,250lb to 7,000ft. Some 120 have been delivered as the US Army H-37A Mojave, the Navy HR2S-1W radar picket and Marine Corps HR2S-1 transport.

Sikorsky S-58 series Well over 1,000 of these helicopters have been built, all with the Wright R-1820-84 (1,525 h.p.). Chief versions are the Army H-34 Choctaw 16-seat transport, the Navy HSS-1 and -1N anti-submarine versions (the -1N is the first true all-weather helicopter) and the Marine Corps HUS-1, which can carry 48 spin-stabilized rockets and four machine guns for close support. S-58s have been supplied to at least seven overseas air forces.

Sikorsky S-61 series One of the company's new family of turbine-driven helicopters with amphibious hulls, the S-61 will eventually be powered by two General Electric T58-GE-8 engines (1,250 s.h.p.) and the first flew in March last year. Basic military variants will be the HSS-2 ASW machine for the Navy and the HR3S-1 transport for the Marine Corps (with large rear doors). Normal operating crew will be four.

Picture (HSS-2), page 51.

Rotor diameter, 62ft; length with blades folded, 72ft 5in: height, 15ft 4in; weight empty, 10,854lb; gross weight, 17,300lb (18,700 overload); max speed, 150 m.p.h.; hovering ceiling in ground effect, 5,300ft; normal range, 285 miles.

Temco TT-1 Pinto Currently the US Navy is evaluating 14 of these trim primary trainers (Continental T69-T-2 of 920lb thrust) in the course of an investigation into flying training generally. Some 100 cadets have so far been taught *ab initio* on Pintos at Saufley Field, Pensacola, Florida, and others have started on piston aircraft in parallel courses. Pinto production has yet to be financed.

Span, 29ft 10in; length, 30ft 1in; height, 10ft 10in; empty weight, 3,139lb; gross weight, 4,400lb; internal fuel, 103 Imp gal; max speed, 4,078lb, 285kt at sea level; cruise, 235kt; s-l climb, 4,078lb, 1,900ft/min; endurance, 90min; service ceiling, 30,000ft; stall, power off, 3,776lb, 63kt; take-off and land over 50ft, 3,000ft and 1,790ft.

Vertol HC-1B Chinook A transport helicopter for the US Army, the Chinook will be an outstanding aircraft. Its twin Lycoming T55-L-5 free-turbine engines (1,940-2,200 s.h.p.) will be mounted Caravelle fashion. The fuselage will provide 1,600 cu ft of unobstructed payload space, 30ft long and accessible through a rear loading ramp up which vehicles can be driven. Provision will be made for seating 40 troops, and the ferrying range will be no less than 1,267 miles. All the latest stability and navigation systems will be incorporated. Roll-out of the first of an initial batch of five is scheduled for November.

Rotor diameter (tandem), 57ft; fuselage length, 48ft 6in; height, 17ft 4in; weight empty, 15,459lb; gross weight, 23,500lb; max speed, 175 m.p.h.; service ceiling, 18,900ft; operational range, with max payload, 230 miles.

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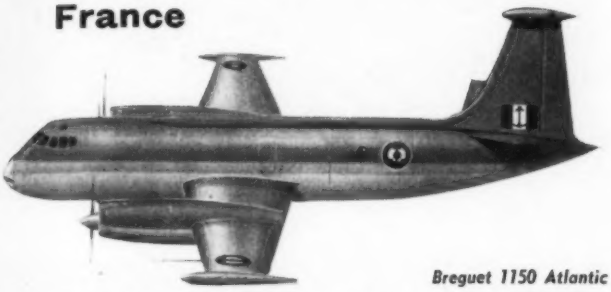
France



Breguet 1150 Atlantic

Breguet 1050 Alizé More than 45 of the 85 Alizés ordered for the French and Indian navies have now been delivered and the production rate is four a month. Powered by a Rolls-Royce Dart Mk 22 turboprop of 1,975 s.h.p. driving a Rotol four-blade propeller, the Alizé carries 462gal of fuel in the fuselage and wings, a crew of three, a retractable radar beneath the rear fuselage, chutes for flares or sonobuoys in the rear fuselage and further sonobuoys in the forward sections of the fairings housing the main undercarriage legs. Offensive weapons include a torpedo or three 353lb depth charges in the fuselage weapon bay, two further depth charges on racks beneath the inner wings and six 5in rockets or two Nord SS.11 missiles under the outer wings. The wings fold and an arrester and catapult hooks are fitted.

Span, 51ft 2in; length, 45ft 6in; equipped weight, 12,566lb; gross weight, 18,078lb; max sea level speed, 285 m.p.h.; patrol speed, 150-230 m.p.h.; service ceiling, 20,000ft; normal endurance, 5hr 20min; take-off run, 1,890ft; landing run, 1,540ft; initial rate of climb, 1,380ft/min.

Breguet 941 Intégral The French government has placed an order for a prototype of this STOL deflected slipstream transport which is to fly in the middle of next year. With a cruising speed of about 250 m.p.h. and a gross weight of about 20 tonnes the Intégral will carry 40-44 passengers and be able to operate commercially from fields 650 to 1,300ft long. Its civil prospects are excellent and a pressurized version is planned, but it also has obvious military potentialities.

Exceedingly high lift for very short take-off and landing is obtained by covering the whole wing in the slipstream of four large propellers driven from a transverse shaft which four 1,250 s.h.p. Turboméca Turmo IIID engines drive through free turbines. The failure of one engine would therefore simply reduce the power supplied to the transverse shaft. Each pair of propellers rotates in opposite directions and the pitch of the outer propellers can be varied differentially to increase lateral control and partially reversed to increase drag before and during landing. For take-off and landing the slipstream is deflected through almost 90° by full-span two-section flaps, the outer rear portions of which also act as ailerons. The undercarriage is to be of the Messier Jockey type and clamshell doors and a retractable ramp will allow rear loading.

Span, 76ft 1in; length, 70ft 6in; gross weight, 44,000lb; useful load, 19,800lb; cruising speed, 250 m.p.h.; take-off run, 330-650ft; landing run, 330ft.

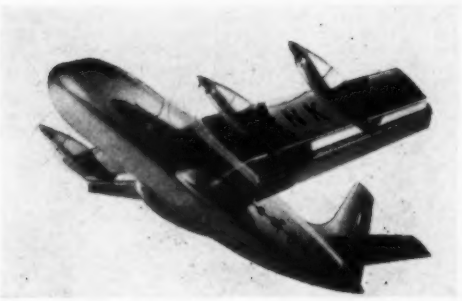
Breguet 1150 Atlantic On December 31 the NATO armament committee decided to select the Breguet 1150 Atlantic as the standard NATO maritime patrol and ASW aircraft. The accompanying illustration is the first to show accurately the configuration of the Atlantic which is to be powered by two Rolls-Royce Tyne 20s each rated at 6,000 e.h.p. and driving de Havilland four-blade propellers. The prototype is to fly in November next year and the Atlantic should be cleared for initial operations in less than three years. Production tooling will be prepared straight away because France, Germany, Holland and Belgium have already placed firm orders; and these countries and the US under MWDP have already contributed funds. A directing committee representing France, Holland, Germany and Belgium is already at work co-ordinating the construction of the aircraft and a technical consulting committee open to all NATO countries has been established so that all interested parties can monitor development. Great Britain and Canada are represented, although they have not yet stated any intention of participating.

Breguet produced the original design study for the Atlantic which won a competition from 25 other companies representing eight countries. Breguet are therefore co-ordinating the whole project and constructing and testing the prototype. After this, the development of the central wing section and nacelles will be taken over by Fokker. Dornier will take charge of the rear fuselage and tail, Sud-Aviation and a Belgian group called ABAP will take over the outer wings. These companies will then produce their components and ship them to Breguet for final assembly and test. Production might well reach 400 aircraft.

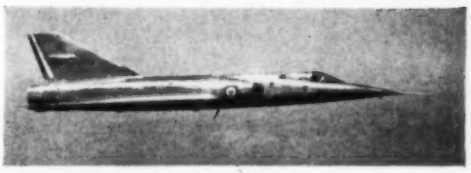
The Atlantic has a "double bubble," pressurized fuselage with a search radar mounted in the nose and a weapons bay in the lower bubble beneath the low-mid-set wing. Very extensive and advanced electronic equipment, partly from the USA and Great Britain, will be incorporated, as well as bulged visual-search windows in the rear fuselage. It is intended that the Atlantic should have an endurance in excess of 20 hours and that, for best economy, it will cruise at high altitude to and from its search area at 373 m.p.h. It will also be capable of flying at very low speeds. Crew complement will be twelve, not all of them on duty at one time.

Span, 124ft; length, 89ft 5in; wing area, 1,295 sq ft; gross weight, 85,980lb; cruising speed, 373 m.p.h.

Breguet 1050 Alizé



Breguet 941 Intégral



Dassault Mirage IV

Dassault Mirage IV Now designated as the manned delivery system for the French nuclear strike force, the Mirage IV is aerodynamically a scaled-up Mirage III with two crew members in tandem and powered by two SNECMA Atar 9s with afterburners. Production aircraft will weigh 105,800lb, a larger version originally proposed having been abandoned because of a reappraisal of the mission profile. Autonomous strike radius, flying to target at supersonic speed and retiring at M0.9, would be 800 miles, but this will be extended by flight refuelling from other Mirage IVs to between 1,200 and 1,800 miles. The prototype has now exceeded M2, having first flown on June 17 last year. A pre-production batch of ten will be powered by Atar 9Js. In 1964 and 1965 40 more Mirage IVs will be delivered. The prototype has now also flown with a shape indicating dimensions of a nuclear weapon recessed beneath the fuselage. An elaborate navigation and bombing radar is being prepared by CSF and anti-missile RCM will be used for defence. The Mirage IV has a new AC electrical system and uses a special high-temperature hydraulic fluid developed by ONERA.

Dassault Mirage III Plans are in hand for the production of some 470 Mirages by 1965 and the type will become the standard French multi-purpose combat aircraft. Ten pre-production aircraft have for some time been under evaluation and the first production machine should be completed in September. The Mirage IIIC, the first production type, was fully described in *Flight* for April 22. It is powered by a SNECMA Atar 9C giving 9,370lb without and 14,100lb thrust with afterburner. A SEPR 841 liquid rocket pack can be installed in a fuselage bay for the intercepter role or replaced by a 90gal fuel tank. Fixed armament is a pack of two 30mm guns replaceable by a rocket

Dassault Mirage IIIC

Dassault Mirage IIIB

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fuel tank or computer. A tandem, two-seat trainer version designated Mirage IIIB has also flown and 30 are on order.

The Mirage III is a basic M2 vehicle which can be rapidly adapted for any role between high-altitude interception or low-level strike. Mirage IIID and E versions have been proposed for low-level strike or reconnaissance roles embodying certain small changes and interchangeable radar or camera noses. Detailed studies have been made for zero-length launching from a Matador missile ramp with solid-fuel boosters. Take-off and landing can be made from PSP steel strips in under 1,000yd. The delta wing has conically cambered leading-edges with slot fences and fully powered elevators, ailerons and small flaps.

Most armament is externally mounted on a fuselage pylon or two under-wing pylons and can include bombs and rockets, the latter in a combined fuel-tank and launcher, and a range of missiles including Nord 5103 and 5104, Sidewinder and AS.30. So far specified is the CSF Cyrano fire-control radar, but it seems likely that this will be replaced by a Hughes system or by Ferranti Airpass 2. Ferrying range or low-level strike missions can be considerably extended by fitting 375gal drop tanks.

Possibly the most interesting variant of the Mirage is the export version, currently being offered to Australia and other countries. It will have a Rolls-Royce Avon Mk 210, rated at 11,800lb without and 16,800lb thrust with afterburner, offering 20 per cent better s.f.c. For even higher performance the RB.146 is offered and Ferranti Airpass 2 would be standard.

Span, 27ft; length, 45ft 5in; wing area, 366 sq ft; t/c ratio, 3.5 per cent; empty weight, 12,350lb; gross weight, 17,600-22,860lb; time to 30,000ft and 72,000ft, 3min and 9min respectively; operational ceiling, 82,000ft; combat speed M1.8; max speed at 36,000ft, M2.3; take-off and landing runs, 2,000ft to 2,800ft according to mission.

Dassault Etendard IVM Seven pre-production Etendards are being built, all but one powered by SNECMA Atar 8 turbojets giving 9,700lb thrust. The third has a Rolls-Royce Avon Mk 51 of 11,200lb thrust and represents the export version. The seventh will be a IVP with a camera nose and all production aircraft will be fitted with a retractable refuelling boom for use with a Douglas hose-reel "buddy" pack. All have a slab tailplane and drooping, dog-tooth leading edge and high-lift flaps. The first production aircraft is to fly in November next year and 49 are to be built at four per month. A second batch of 50 will follow and all are destined for the French carriers *Clémenceau* and *Foch*. All have the Dassault Aida radar for limited search and tracking and for ranging during ground-attack. A strake beneath the nose increases directional stability and houses the aerial for the Nord missile-control radio. Fixed armament is a pack of two 30mm guns and underwing pylons can carry Nord 5103, AS.30 or Sidewinder missiles, rocket packs, bombs or tanks. Four 130gal under-wing tanks will allow a ferry range of 2,000 n.m. The Etendard may be launched from the 150ft catapult without wind and arrested by Mk 13 gear. Leading-edges are drooped 15° for combat and 30° and 60° flap for landing. The aircraft can start a loop at 250kt and pull 5g at 300kt. Using its spoiler ailerons it can roll in 3sec at 600kt. The Avon-powered version is called IVB and has flap blowing.

Span, 31ft 6in; length, 47ft 3in; normal gross weight, 18,000lb; max gross weight, 23,000lb; max level speed, M1.08; landing run with drag chute, 1,640ft; operational ceiling, 50,000ft; time to 40,000ft, 4min 30sec; ferrying range, 2,000 n.m.; low-level attack range, 370 miles.

Dassault MD.410 Spirale This is the purely military version of the Communauté and differs from it mainly in having a fuselage arranged for military offensive duties. Transport operations are still possible, but the cockpit is arranged for a single pilot and window area greatly increased to provide all-round visibility. An aiming position is provided in the nose and two 30mm guns are mounted in blisters beneath the wing-roots. Performance is similar to that of the Communauté.

Dassault Etendard IVB

Dassault MD.410 Spirale

Dassault MD.415 Communauté Built as a private venture, this multi-purpose aircraft first flew in May last year and is now being developed jointly with Sud-Aviation. It has a circular section fuselage which is pressurized and provided with large and small access doors at the rear and a transparent nose for missile- or bomb-aiming. The powerplant is two Turboméca Bastans giving 750 s.h.p. each and six fuel tanks are housed in each wing. Perforated spoilers above the wing, inboard of the engines, act as air-brakes and further spoilers outboard assist lateral control to provide high manœuvrability for offensive operations. Tail-plane incidence is variable and the rudder is fully powered. The under-carriage legs are ingeniously arranged to shorten so that the twin main-wheels can retract into compartments aft of the wing spars. The Communauté can act as a command transport, crew trainer, parachute and supply aircraft and is additionally fitted with under-wing pylons for the carriage of rockets, bombs and small missiles.

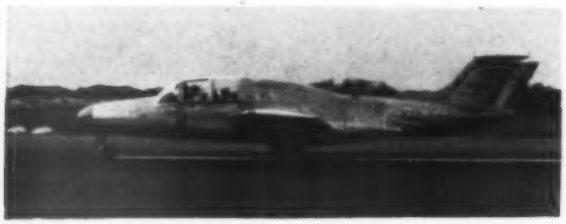
Span, 53ft 11in; length, 42ft 8in; empty weight, 7,960lb; gross weight, 13,007lb; cruising speed at 19,700ft, 310 m.p.h.; landing speed, 90 m.p.h.; single-engined climb at sea level, 395ft/min; single-engined ceiling, 16,400ft; service ceiling, 36,100ft; take-off distance to 50ft, 1,245ft; landing from 50ft, 1,017ft; max range with reserves, 1,550 miles.

Max Holste MH.1521 Broussard More than 250 of the 400 Broussards ordered by the French government have now been delivered and the present rate of production is six per month. Powered by a P & W R-985 giving 450 h.p., the Broussard has exceptional short-field performance and an ample freight compartment and large loading door. Passenger, freight, ambulance and flying command post versions are available. A version of the Broussard with double slotted flaps and full-span leading-edge slats has been designated MH.1522.

Span, 45ft 1in; length, 28ft 4½in; equipped weight, 3,637lb; gross weight, 5,953lb; max speed, 142 m.p.h.; stalling speed, 57.5 m.p.h.; initial rate of climb, 785ft/min; take-off run, 655ft; landing distance from 65ft, 1,310ft.

Morane Saulnier MS.760 Paris Eleven countries have now ordered this twin-jet liaison or business four-seater. Armament can be fitted if required and a two-seat trainer is available. The cabin is pressurized and air-conditioned. The engines are Turboméca Marboré IIs. A total of 93 Paris has been ordered for export and 80 have been delivered.

Span, 33ft 3in; length, 33ft; empty weight, 4,280lb; gross weight, 7,650lb; max speed at sea level, 405 m.p.h.; cruising speed, 350 m.p.h.; landing speed, 96 m.p.h.; single engined climb at 3,300ft, 420ft/min; climb to 23,000ft, 18min; service ceiling, 32,800ft; take-off run, 820yd; still-air range at 23,000ft, 930 miles.

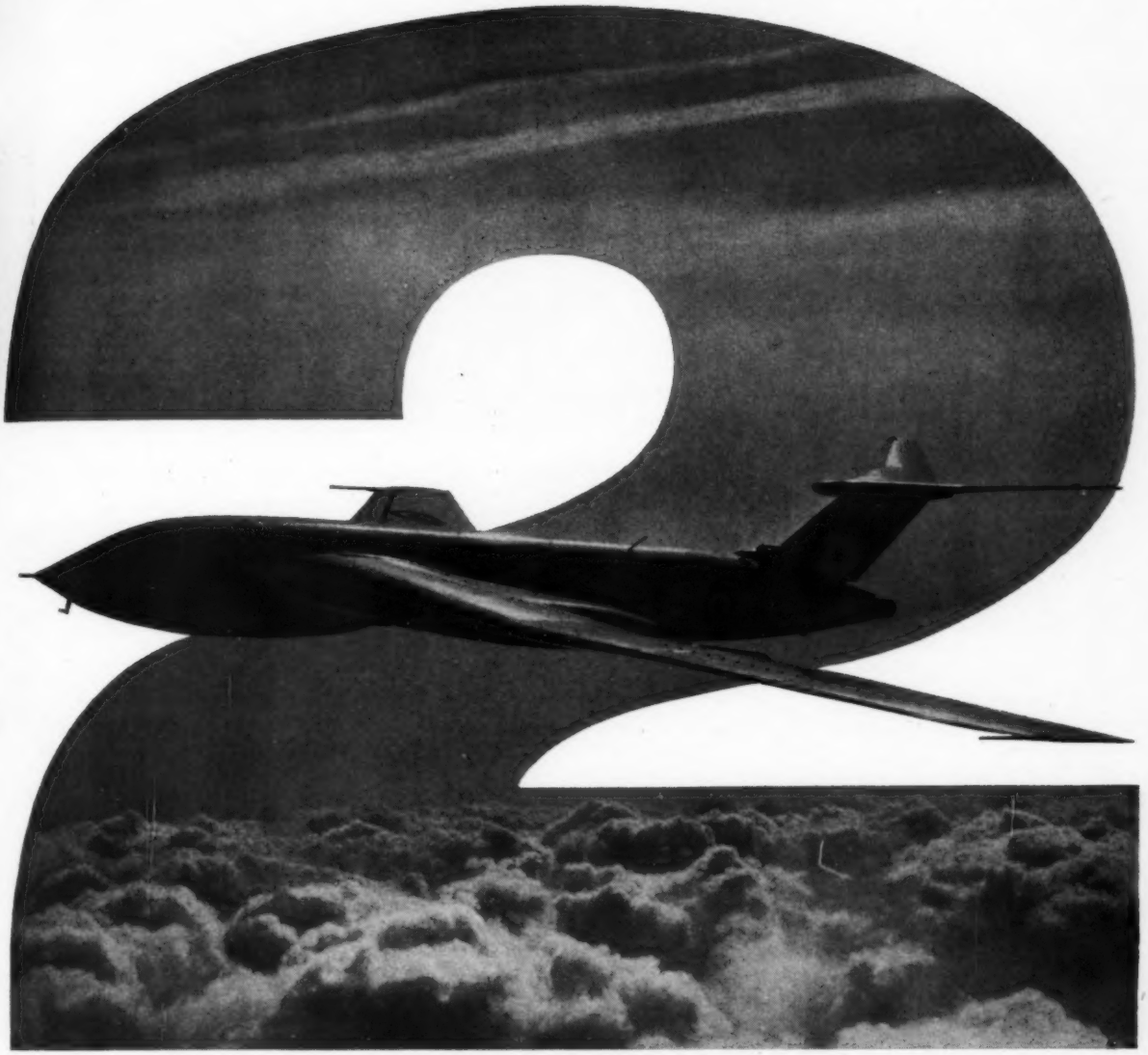


Morane Saulnier MS.760 Paris

Nord C.160 Transall

Max Holste MH.1521 Broussard

mightier VICTORS will keep your peace



Victor 2s are even more potent versions of the sonic Victor 1s in V-bomber service with the Royal Air Force—and still the largest aircraft to have breached the sound barrier.

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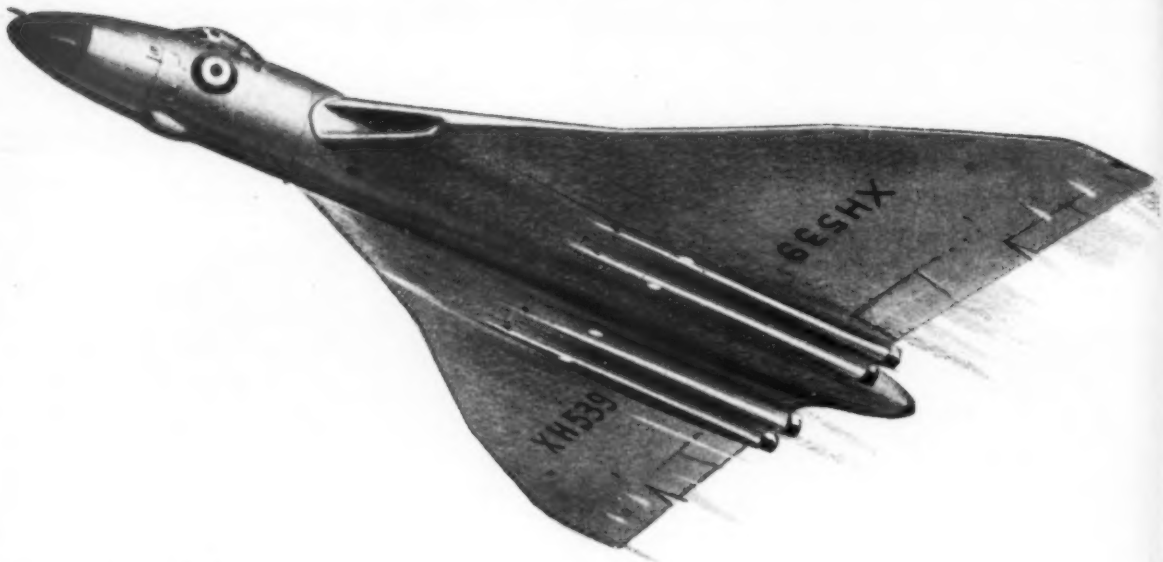
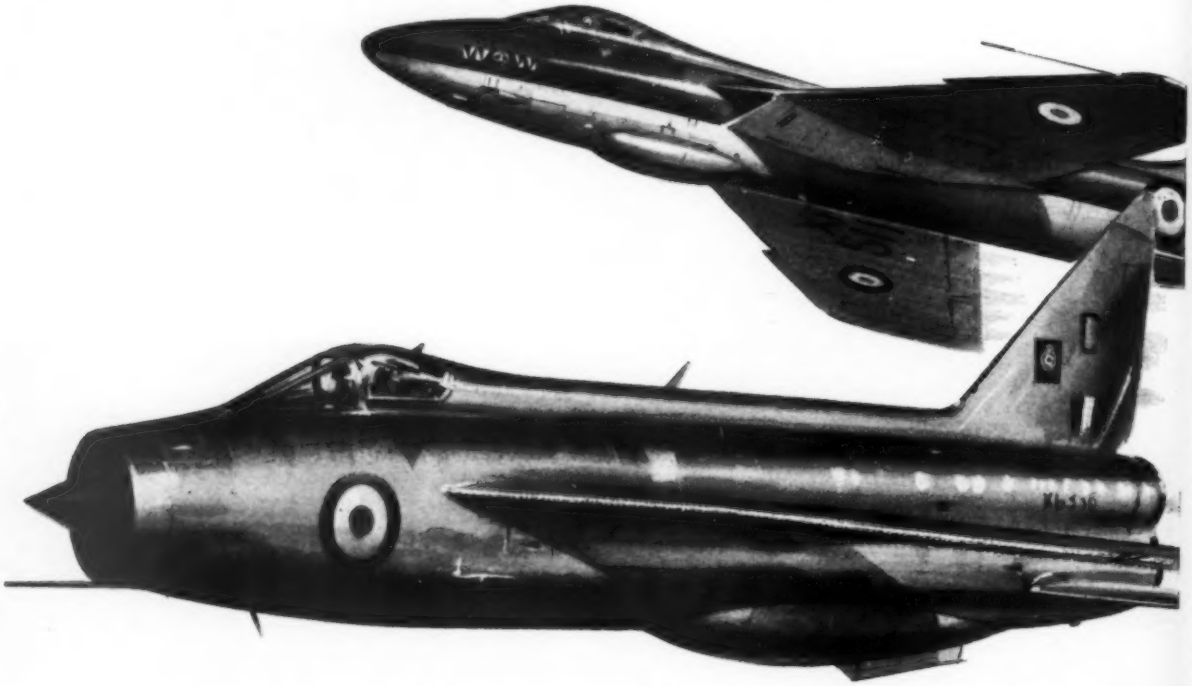


Military aircraft *(for instance)*



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TAC210

Sud SE.3200 Frelon

Sud SE.3160 Alouette III (SE.3130 Alouette II in background)

MILITARY AIRCRAFT OF THE WORLD . . .

Nord-Aviation C.160 Transall The Franco/German agreement for the construction of three prototypes of this military freighter was signed in Paris on March 28 and the German contribution is to be 95m DM (about £7½m). Nord are to assemble one prototype in France and the three German companies associated in the project, Hamburger Flugzeugbau, Weser Flugzeugbau and Blume Leichtbau und Flugtechnik, will between them make two more. The first should fly in mid-1962 and will be powered by Rolls-Royce Tynes of about 6,000 h.p. which will form the standard powerplant. It is reported that Nord will make the wing and nacelles of production aircraft, Weser and Hamburger the fuselage and Blume the tail. About 150 should eventually be built.

Relatively little has yet been released about the Transall (the name stands for transport alliance), but models show it to have a rear-loading ramp. The Messier Jockey tandem undercarriage units retract into fuselage bulges.

Span, 131ft; length, 97ft 4in; gross weight, 90,390lb; cruising speed, 275kt.

Nord-Aviation 3400 More than 30 of these two-seat artillery observation aircraft have now been delivered to the French army air service and 150 were ordered. A flight-test report on this type appeared in *Flight* for March 11 this year. Powerplant is the Potez 4D.34 inverted inline engine giving 260 h.p. Fuel capacity is 48gal. The 3400 can accommodate a stretcher and fulfil other utility roles.

Span, 43ft; length, 27ft 8in; empty weight, 2,028lb; gross weight, 2,976lb; max speed, 160 m.p.h.; cruising speed, 124 m.p.h.; min speed, 43 m.p.h.; sea level rate of climb, 1,375ft/min; take-off and landing distances less than 330ft; range, 620 miles.

Nord-Aviation 3202 The French army air service ordered 100 of these fully aerobatic, tandem two-seat trainers and more than 25 have already been delivered. Powerplant is a Potez 4D.32 giving 240 h.p.

Span, 31ft 2in; length, 26ft 8in; empty weight, 1,813lb; gross weight, 2,690lb; max speed at sea level, 161 m.p.h.; min speed, 51.5 m.p.h.; range, 620 miles.

Nord-Aviation 2501 Noratlas Production in France of this twin-boom transport (two 2,040 h.p. SNECMA-built Hercules) is now almost completed and more than 190 have been delivered. The total to be built, including those made under licence in Germany, will be 370. The Noratlas has rear loading doors which may be removed for heavy parachuting and one version was adapted for search and rescue work. Another specialized version for assault transport, designated 2506, did not go into production.

Span, 106ft 7in; length, 72ft; equipped weight, 28,765lb; gross weight, 50,705lb; max speed, 273 m.p.h.; cruising speed, at 5,000ft, 201 m.p.h.; single engined rate of climb, 200ft/min; service ceiling, 24,600ft; single engined service ceiling, 7,545ft; take-off to 50ft, 863yd; landing run with propeller braking, 459yd; max range, 1,550 miles.

Potez-Air Fouga CM.170 Magister More than 350 of these trainers powered by two Turboméca Marboré II engines are already in service and licence production is in hand in Germany, Finland and Israel, respectively for 250, 45 and 44 aircraft. Austria has bought six and Belgium 45 and French production is now running at the rate of five a month. The total of French-built Magisters is expected to reach 600 eventually.

Span, 39ft 10in; length, 33ft; empty weight, 4,740lb; gross weight, with tip tanks, 6,835lb; max speed at 30,000ft, 443 m.p.h.; initial rate of climb, 3,345ft/min; take-off run, 1,800ft; range at 30,000ft with reserves, 575 m.p.h.

Potez-Air Fouga CM.175 Zéphyr The French Navy has ordered 30 of these deck-landing versions of the Magister trainer and more than 20 of them have already been delivered. The type differs from the land-based Magister mainly in having catapulting and arrester hooks, a larger and stronger undercarriage and individual sliding canopies instead of clam-shell units. Figures given below are those which differ from the Magister.

Empty weight, 5,180lb; normal gross weight, 7,055lb; max speed at 23,000ft, 403 m.p.h.; sea level rate of climb, 2,950ft/min; landing speed, 104 m.p.h.; min catapult speed, 109 m.p.h.; max arrester gear deceleration, 4.5g.

Sud-Aviation SE.3200 Frelon Destined for all three French armed services and for civil use, the Frelon first flew on May 10 last year and one prototype has just gone to the CEV. They are powered by three Turboméca Turmo IIIBs, two mounted ahead of the rotor and one behind, but production Frelons will have the 1,100 h.p. Turmo IIIC derated to 900 h.p. and capable of maintaining this power up to 10,000ft or 100° F. The four-bladed main and tail rotors have powered controls and full night-flying equipment and autopilot are specified. All fuel is carried in the streamlined nacelles beside the cabin and the tail can be hinged sideways to allow direct loading of vehicles into the 22ft 11½in-long cabin. The cowling panels along the whole length of the engine and transmission section hinge down to form servicing walkways. Sliding doors provide normal access for personnel. Typical mission capabilities are 24 fully-equipped troops carrried for 62 miles, 15 stretcher patients and two attendants for 250 miles, or 4,400lb of freight stowed or slung for 185 miles. The Frelon can winch up ten people from the sea and the anti-submarine version is to be capable of three-hour offensive patrols. Towing of ships and mine-sweeping are also possible.

Rotor diam, 49ft 2½in; overall length, blades folded, 48ft 10½in; empty weight, 9,920lb; max gross weight, 17,640lb; max speed, 153 m.p.h.; cruising speed, 144 m.p.h.; two-engined ceiling, 7,850ft; three-engined ceiling, 12,400ft; endurance 3½hr.

Sud-Aviation SE.3160 Alouette III This is an extrapolation of the Alouette II and can carry a pilot and six passengers or eight troops. The powerplant is a Turboméca Artouste III capable of giving 700 s.h.p. but derated to 450 s.h.p. The fuselage has been widened and faired and a nosewheel undercarriage, replacable with pontoons or skis, is now fitted. Ample baggage space exists beside the fuel tank beneath the rotor transmission, and sliding rear doors and hinged front doors may be opened to uncover the whole cabin or removed for quick loading. Hoist and sling may also be provided. During recent trials the Alouette III landed with four occupants and 330lb freight on the summit of Mont Blanc and successfully restarted its engine on the Dome du Gouter at 13,300ft.

Rotor diam, 36ft 1in; overall length, blades folded, 33ft 0½in; empty weight, 2,300lb; max weight, 4,630lb; max speed, 124 m.p.h.; cruising speed, 115 m.p.h.; hovering ceiling in ground effect, 12,300ft; range with max payload, 155 miles.

Sud-Aviation SE.3130 Alouette II A series of 500 of these light helicopters is being built at the rate of six a month and well over 300 have already been delivered. The French Services ordered 261, and foreign customers 217, including 130 for Germany, 21 for Sweden and 10 for Switzerland. The Alouette is used in 21 countries and has proved very successful in both military and civil operations. Powerplant is a 400 h.p. Turboméca Artouste II constant-speed shaft turbine.

Rotor diam, 33ft 6in; overall length, blades folded, 31ft 6in; empty weight, 1,875lb; max gross weight, 3,527lb; max speed, 108 m.p.h.; cruising speed, 106 m.p.h.; hovering ceiling in ground effect, 6,560ft; cruising endurance, 3hr 15min.

Sud-Aviation SO.1221 Djinn More than 100 of these two-seat, tip-jet-driven light helicopters have been delivered of the 133 ordered. Nine foreign countries have ordered 26 of them. The powerplant is a Turboméca Palouste air generator.

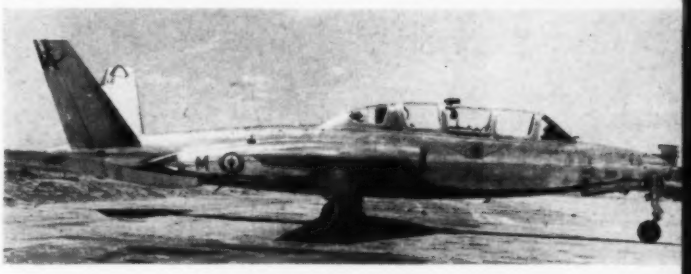
Rotor diam, 36ft 1in; length of fuselage, 17ft 4in; empty weight, 794lb; military gross weight, 1,765lb; max speed, 80 m.p.h.; cruising speed, 66 m.p.h.; hovering ceiling in ground effect, 5,900ft; max height for vertical take-off, 9,200ft; range, 118 miles.

Sud-Aviation SE.117 Voltigeur Although the project once seemed abandoned, Sud are apparently continuing development of the SE.117 Voltigeur powered by two Turboméca Bastan turboprops giving 805 e.h.p. each. The SE.117 is a development of the earlier, piston-engined SE.116, but has an enlarged fuselage providing greater accommodation for personnel, freight or casualties.

Span, 58ft 11in; length, 40ft 3½in; wing area, 448.8 sq ft; empty weight, 9,260lb; loaded weight with and without external stores, 14,375lb and 12,425lb; cruising speed, 285 m.p.h. at 11,500ft.

(*Continued on page 72, after Canadian and Russian sections*)

Nord 3400

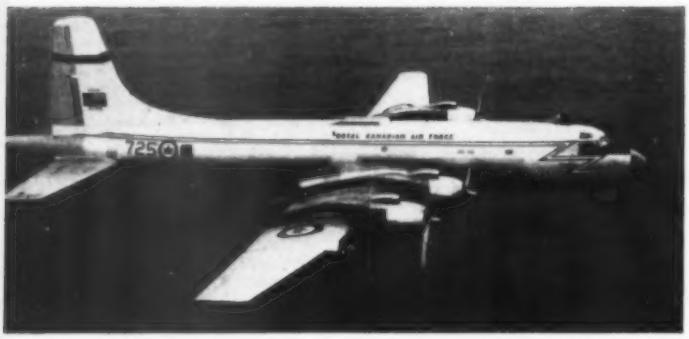


Potez-Air Fouga CM.175 Zéphyr

MILITARY AIRCRAFT OF THE WORLD . . .

Canadair CL-44-6

Canadair CL-66B



Canadair Argus

Canadair CL-41

de Havilland Canada Caribou

Canada

Avro Aircraft CF-100 Late-mark CF-100 all-weather fighters (two Avro Orendas) continue in service with the RCAF and the Belgian Air Force though production ceased at the end of 1958. The last version —the Mk 5—had increased wing and tailplane area and an all-rocket armament.

Span, 60ft 10in; length, 54ft 2in.

Canadair Sabre Between 1951 and 1958 Canadair manufactured a total of 1,815 Sabres, under NAA licence, with J47 or Orenda engines. They went to the RCAF, the USA, Greece, Turkey, Italy, Yugoslavia, South Africa, Colombia and West Germany. Data for the Sabre 6 (Orenda 14) are:—

Span, 37ft 1in; length, 37ft 6in; weight empty, 10,840lb; gross weight, 15,100lb; max speed, 700 m.p.h.

Canadair Argus The Argus maritime-reconnaissance and anti-submarine aircraft is a derivative of the Bristol Britannia, using the basic wings, tail and main undercarriage. It has, however, a completely new, unpressurized, fuselage and is powered by Wright Turbo-Compound piston engines. A first-hand account of a flight in an Argus, detailing much of its military equipment, appeared in *Flight* of November 27 last. The makers describe the aircraft in these terms:—

"The Argus has been developed to meet the increasingly serious threat of long-range submarines, now all the more important because of the limitless range afforded by atomic propulsion and the use of submarines to launch ballistic missiles. Whereas there may be as long as 25 minutes between firing of a land-launched ICBM and hitting the target, a missile launched from a submarine at a predetermined spot below the surface of the sea could be fired within a much shorter time of hitting the target. To effectively counter this menace, a highly sophisticated search and attack weapon system has been evolved. The Canadair Argus is the aircraft which mounts this system. An armament load of about 8,000lb can be carried by the Argus to a patrol area more than 750 nautical miles from base, an extensive search completed and the aircraft return to base with enough reserve fuel for 500 miles diversion. This can be accomplished with the aircraft carrying full armament throughout the operation. Special equipment carried by the Argus includes an automatic navigational computer which indicates latitude and longitude, and which gives the distance in miles from a datum point accurate to within 2 per cent; passive sonobuoys to drop and leave floating in the sea so that they can relay cavitation noise of submarine engines and propellers; the 'Julie' weapon for detecting submarines and other weapons which for security reasons cannot be described. At the tail of the Argus is a long pointed boom known as MAD (magnetic anomaly detection) equipment . . . Having found a submarine under the surface, the Argus attacks it with depth charges and homing torpedoes. Surfaced submarines and other vessels are attacked with either missiles, rockets, torpedoes or bombs. In addition to this primary role, the Argus can be used for mine-laying, long-range convoy duty, barrier patrols across harbours or straits, and for maritime search and rescue operations."

Span, 142ft 4in; length, 128ft 3in; gross weight, 148,000lb; max speed, 288 m.p.h.

Canadair CL-41 This is a new jet trainer with a structure designed to an ultimate load factor of 11. The seats are placed side by side and the intakes for the Pratt & Whitney JT12 turbojet of 2,900lb thrust are at the wing roots. The "T" tail is claimed to be a desirable feature for an aircraft of this type, because the vertical surfaces are not blanketed by the tailplane during violent aerobatic manœuvres and the rudder is particularly effective in spin recovery. The makers state:—

"A wide speed range—stall at 65kt, level top speed of 412kt—provides a good safety margin for operation at low altitude and at the same time permits realistic training in piloting and navigation at high speeds at altitude. The design diving Mach number of 0.8 and the use of large fuselage-mounted dive brakes give the CL-41 the highest rate of descent of any jet trainer. Over a 50ft obstacle the take-off distance is 1,830ft and the landing distance is 1,920ft, at maximum weight. Automatic pressurization and air conditioning are provided. Instructor and student can fly for extended periods at heights up to 18,000ft without using oxygen and up to 38,000ft (cabin altitude 23,000ft) with oxygen."

Span, 36ft 4in; length, 32ft; gross weight, 6,500lb; max speed, 474 m.p.h.

Canadair CL-44-6 This is another development of the Bristol Britannia and will replace the Canadair North Star in service with the RCAF, which Service designates the aircraft CC-106. An aircraft of the type has been flying since last November and twelve are to be delivered within the next year. The makers describe the type thus:—

"Three alternative configurations provide for transport of 60,000lb of cargo, with conversion kits available to allow rapid change-over to either passenger or casualty evacuation layouts. Cargo handling has been given special attention and roller-conveyor sections are located fore and aft of the large rear loading door. Immediately inside both front and rear doors are ball-conveyor sections which allow side-loaded cargo to be quickly pushed along the fuselage. In passenger form the CC-106 seats 134, with two attendants, has drop-down oxygen masks and is equipped with three removable galleys. For casualty evacuation, 80 litter cases with six attendants can be accommodated and there are facilities for operation of iron lungs and resuscitators. Normal flight crew is five for all three layouts, plus an air traffic assistant for the cargo configuration.

"In some respects the CC-106 resembles the CP-107 Argus, having similar wings, tail unit, control surfaces and main undercarriage, but the fuselage is

12ft longer and is pressurized, and the wing has integral fuel tanks instead of bag-type fuel cells. The most important new feature is the choice of four 5,730 e.h.p. Rolls-Royce Tyne 12 turboprop engines."

Span, 142ft 4in; length, 136ft 7in; gross weight, 205,000lb; max speed, 405 m.p.h.

Canadair CL-66B This type is known to the Royal Canadian Air Force as the CC-109. In that Service it is a replacement for the Dakota. It is generally similar to the civil Canadair 540 and is powered with two Napier Eland turboprops. There is a large cargo loading door in the rear fuselage and a 300lb/sq ft cargo floor. Nose-mounted radar is standard equipment. Either 11,800lb of cargo, 40 passengers or 15 stretcher cases can be carried—a change from the basic cargo configuration to either of the others being quickly effected with the appropriate conversion kit at squadron level. Ten CL-66s are on order for the RCAF.

Span, 105ft 4in; length, 81ft 6in; gross weight, 57,500lb; max speed, 335 m.p.h.

Canadair CF-104 This is the designation of the Lockheed F-104 to be built by Canadair for the RCAF. The type is described under "USA."

de Havilland Canada Caribou This outstanding STOL transport (two Pratt & Whitney R-2000 engines of 1,450 h.p. each) has been adopted by the US Army under the designation YAC-1. The original order for five has been supplemented by an additional order for 22, to be delivered early next year. Apart from its field performance the aircraft is notable for its loading and stowage facilities. As a cargo carrier it is capable of carrying heavy and diversified loads, with easy access to the 1,150 cu ft volume cabin through the wide rear loading doors. Numerous tie-down rings in the cabin floor permit quick securing of cargo, keeping turn-around time to a minimum. The upswept tail of the AC-1 has a ground clearance of 9ft 6in, allowing a standard Army vehicle to back directly up to, and level with, the aircraft cabin floor for quick handling of bulky cargo. Portable rollers are easily installed from truck-bed into the cabin to transfer a full payload of over three tons in short order. The bottom part of the rear loading door acts as a ramp at truck-bed height or may be lowered to approximately a 45° angle for fast loading of troops. The upper part of the door retracts up into the roof of the aircraft and may be jettisoned in case of an emergency.

Some handling impressions of the Caribou were printed in *Flight* of November 20, 1959. Our representative concluded his report: "To sum up, I found the Caribou tractable, good on one engine and apparently viceless. Field performance, both in terms of length of run and ease of control, was truly remarkable. This aircraft sets new standards in big, conventional STOL types."

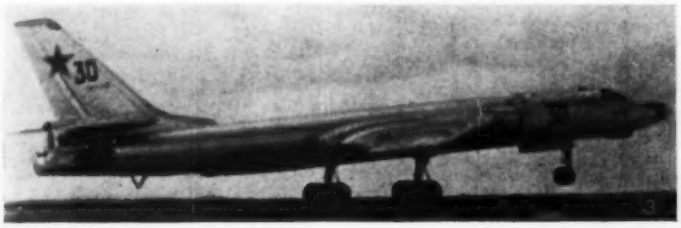
Span, 96ft; length, 72ft 7in; gross weight, 26,000lb; cruising speed at 7,500ft with 50 per cent power, 182 m.p.h.; take-off run, 540ft; distance to 50ft, 1,020ft.

de Havilland Canada Otter Known to the US Army as the U-1 and to the US Navy as the UC-1, the Otter (Pratt & Whitney R-1340 engine of 600 h.p., is also utilized by the RCAF. It carries from 9-11 passengers or, in the ambulance role, six stretchers. The D.H. Canada-designed combination wheel/ski landing gear is available, and an amphibian gear has also been developed by Edo. The following data apply to a typical Otter landplane:—

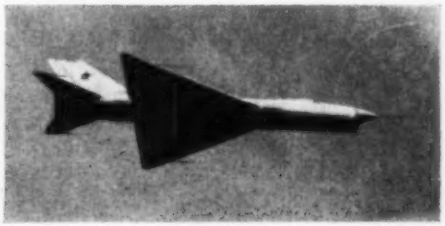
Span, 58ft; length, 41ft 10in; gross weight, 8,000lb; cruising speed, 138 m.p.h. at 5,000ft; take-off distance to 50ft, 1,310ft.

de Havilland Canada Beaver The US Army and the USAF know this aircraft as the L-20. A Pratt & Whitney R-985 is the standard powerplant, although one aircraft has been fitted with an Alvis Leonides, with an improvement in performance. Seating can be provided for up to seven passengers, and wheel, float or ski undercarriages are available. An amphibian version is also offered. Thirty-six Beavers have just been ordered for the British Army Air Corps.

Span, 48ft; length, 30ft 3in; gross weight, 5,100lb; cruising speed, 143 m.p.h. at 5,000ft; take-off distance to 50ft, 1,015ft.



"Badger"



"Fishpot"

USSR

Information on Russian front-line and prototype aircraft continues to be extremely scarce and, when available, in many cases suspect. In the following notes there is no dead wood, as represented by the older types and a minimum of conjecture, which so frequently characterizes discussions of supposed newer designs. Where a designation is not known with some degree of certainty the NATO code-name is given.

Antonov An-10(?) In the previous "Military Aircraft of the World" issue (June 20, 1958) was illustrated the An-4 "Camp" twin-turboprop military transport. This type does not appear to have entered service, but a four-engined military counterpart of the An-10 civil transport, embodying a rear fuselage tail and stern gun position, as on the An-4, is now with squadrons. Unlike the civil An-10, this aircraft has rear-loading facilities.

"Backfin" There is nothing new to report on this supposed supersonic twin-jet bomber, for which a Mach number of at last 1.5 has been estimated.

"Badger" Reported to have the designation Tu-16, "Badger" has two turbojets of about 20,000lb thrust. Armament is housed in dorsal, ventral and tail barbettes, and there are sighting blisters in the sides of the rear fuselage. Maximum speed should fall little short of 600 m.p.h. This aircraft was the military precursor of the Tu-104 jet transport.

"Bear" The military (strategic bomber) forerunner of the Tu-114 transport, "Bear" has four turboprops possibly of 12,000 s.h.p. each. Span is about 177ft and gross weight possibly in excess of 400,000lb. Cruising speed could be as high as 500 m.p.h. Armament is carried.

"Bison" This type continues as Russia's standard heavy jet bomber. It has four root-mounted axial-flow turbojets of some 20,000lb thrust each and the span is about 170ft. Maximum speed should be at least 600 m.p.h. and there are twin-gun barbettes in the tail, above the fuselage and under the wing.

"Blowlamp" Somewhat resembling the Douglas Skywarrior, this bomber has a tandem-type undercarriage and visual bomb-sighting station.

"Bounder" Reported as a supersonic delta-wing four-jet bomber.

"Fishbed A" A delta-wing experimental fighter.

"Fishbed B" Resembles "Fishbed A" but has slightly blunted wing-tips.

"Fishpot" This delta-wing fighter may already be in service as the T-431, which has attained heights of the order of 95,000ft. Fire-control radar may be installed in the chin-type intake.

"Fitter" A single-jet, swept-wing fighter with straight trailing-edge on the inboard wing section. Mach number probably 1.5-2.

Yak-25 Code-named "Flashlight A," this is a standard all-weather fighter with two axial-flow turbojets of some 8,000-9,000lb thrust. The crew of two sit in tandem, and in addition to gun armament there is provision for a battery of air-to-air unguided rockets (possibly guided missiles also).

"Flashlight B" Apparently a tactical light bomber development, with glazed nose.

"Flashlight C" A refined all-weather fighter development of "Flashlight A" having afterburners and probably supersonic.

Mig-19 ("Farmer") Well established as a fighter and fighter-bomber, this is a twin-jet aircraft probably capable of about M1.5. The type can be zero-length launched and armament can almost certainly include guided missiles.

Mig-21 ("Faceplate") A developed "Farmer" with a single axial-flow turbojet and a tail fairing which might house an auxiliary rocket.

Mi-6 The latest and largest Soviet military helicopter, having two turbines of 4,635 s.h.p. each, capable of well over 160 m.p.h. and of lifting about 26,500lb to a height of 4,400ft. Gross weight is probably over 70,000lb.

"Bear"

"Bison"

Mig-19

MILITARY AIRCRAFT OF THE WORLD . . .

(*French section continued from page 69*)

Sud-Aviation SO.4050 Vautour II Production of 150 of these swept-wing twin-jet aircraft in attack, bomber and night fighter versions is now almost completed, and the first two versions form the backbone of the French bomber force. All versions of the Vautour can exceed M1 in a dive and are powered by two SNECMA Atar 101E turbojets of 7,700lb thrust each.

The Vautour II-A is a single-seat tactical support aircraft with four DEFA 30mm guns and radar mounted in the nose. Up to 240 unguided rockets or 10 bombs can be carried in the fuselage weapon bay and under-wing pylons can carry 275gal drop tanks, Matra rocket packs or 1,000lb bombs.

The Vautour II-B is the bomber, without guns and carrying a bomb aimer in a transparent nose section in addition to a single pilot. Special equipment is fitted to allow dropping of bombs at transonic speeds. A Vautour II-BR was fitted with a flight refuelling probe.

The Vautour II-N is a tandem two-seat all-weather fighter with a CSF fire-control radar and four 30mm guns in the nose. The weapon bay can accommodate up to 240 rockets and the under-wing pylons can carry 275gal drop tanks, rocket packs, or missiles such as the Nord 5103 and MATRA 530.

Six Vautours were supplied to the Israeli Air Force and 40 II-As, 40 II-Bs and 70 II-Ns were ordered for the French Air Force.

Span, 50ft; length, 50ft; empty weight, 22,000lb; gross weight, 33,000 to 44,000lb; max speed, 680 m.p.h.; ceiling, 49,200ft; take-off and landing runs less than 2,625ft.

Germany

C.160 Transall Three German companies, Hamburger Flugzeugbau, Weser Flugzeugbau and Blume Leichtbau und Flugtechnik, are associated in the design and construction of this military freighter. Further details under Nord-Aviation on page 69.

Lockheed F-104G In future, the only two operational aircraft in the German air force will be the Fiat G 91 and the Lockheed F-104G. For the latter a major industrial undertaking is under way, with a group of Heinkel, Messerschmitt, Dornier, Siebel and BMW associated with Dutch, Belgian and possibly Italian companies to produce 574 or more F-104Gs for the German air force, 200 for the Netherlands and 100 for Belgium. Italy may also acquire some. Preliminary deliveries from Lockheed include 66 F-104Gs and 30 F-104F trainers to Germany and 20 F-104Fs to the Netherlands. Assembly of the first German-built F-104 should begin at the end of next year.

Dornier Do 27

Dornier Do 27 Production of 428 of these STOL general purpose aircraft powered by Lycoming 275 h.p. engines is now well towards completion. The German armed forces are receiving Do 27A utility and Do 27B dual-control versions and the Do 27H2 with 340 h.p. Lycoming engine and larger fin and rudder is available. All are six-seaters and can have various types of undercarriage.

Span, 39ft 4½in; length, 31ft 6in; empty weight, 2,167lb; gross weight, 3,460lb; cruising speed, 127 m.p.h.; stalling speed, 36 m.p.h.; ceiling, 18,040ft; take-off to 50ft, 186yd; range, 540 miles.

Entwicklungsring Sud Supersonic VTOL Design teams from Heinkel and Messerschmitt and an armament and electronics team from Bölkow are working on the design of an M3 VTOL fighter to be equipped with six tilting lift engines developed by MAN from the Rolls-Royce RB.153. The design is in the very early stages, but Messerschmitt representatives have visited Short & Harland to investigate the stabilization and control system applied to the SC.1. The type is certain to figure prominently in the joint British/German/French/Italian discussions of VTOL aircraft and it has already been officially stated that it may be adopted for the RAF. French reports give the thrust of the RB.153 as 4,960lb and its t/w ratio as 16:1.

Hindustan HT-2s

India

Hindustan HF.24 No details have been officially released concerning this fighter project, but it is reported that the German Kurt Tank is responsible for the design and that it is a light fighter. It apparently has two Bristol-Siddeley Orpheus, probably of BOr.12 rating, mounted in the fuselage and is a single-seater. Construction of a prototype is well advanced. Supersonic speed capability seems certain.

Hindustan HT-2 This tandem two-seat basic trainer is in service with the Indian Air Force and Indian Naval Air Arm as well as with Indian civil aviation training establishments and flying clubs. It has been sold to Singapore and Ghana and is still available for export. The powerplant is a Blackburn Cirrus Major III giving 155 h.p. and fuel tankage is 26gal.

Span, 35ft 2in; length, 24ft 8in; empty weight, 1,540lb; gross weight, 2,240lb; max speed, 130 m.p.h.; cruising speed, 115 m.p.h.; stalling speed, 52 m.p.h.; service ceiling, 14,500ft; range, 350 miles.

Italy

Agusta AZ-101G The Italian air force has ordered a prototype of this 30-passenger helicopter which is to be powered by three de Havilland Gnomes mounted radially about the transmission above the main cabin. Main and tail rotors each have four blades, there is a four-wheel under-

Agusta AZ-101G (artist's impression)

carriage and the loading ramp at the rear of the cabin may be kept open in flight. The three 1,050 h.p. Gnomes for the prototype are to be delivered later this year and ground running is expected to begin early next year. Several versions of the AZ-101G are in prospect, including one for antisubmarine operations.

Rotor diam, 64ft; fuselage length, 54ft 1in; empty weight, 12,566lb; gross weight, 24,030lb; max speed, 143 m.p.h.; cruising speed, 125 m.p.h.; hovering ceiling in ground effect, 9,840ft.

Agusta Bell 47 Series Both the Bell 47G and J series have for some years been made under licence in Italy by Agusta, and many of them have been supplied for military use.

Fiat G 91 Now in production as the standard lightweight strike fighter for NATO countries, Fiat G 91s are beginning to take their place in front-line squadrons. The G 91 is a single-seater, powered by a licence-built Bristol Siddeley Orpheus 803 of 5,000lb thrust. Fixed armament consists of four 0.5in machine guns in two quick-change packs in the fuselage flanks. Two under-wing pylons can carry either tanks, Napalm, various types of unguided rockets and rocket packs, air-to-air missiles or Nord 5103 or AS.30 air-to-ground missiles. The G 91 has low pressure tyres and a drag chute for operation from grass fields and is capable of high subsonic speed at low level. A complete set of lightweight servicing equipment has been designed so that G 91 squadrons can operate independently in the field with the minimum of personnel and equipment. G 91s have been ordered by Italy, Germany, Turkey and Greece, and 232 are to be built under licence by Heinkel, Messerschmitt and Dornier for the German Air Force. The engines will be made by Klockner-Humboldt-Deutz. These machines will have a fixed armament of two 30mm guns instead of the four 0.5in machine guns.

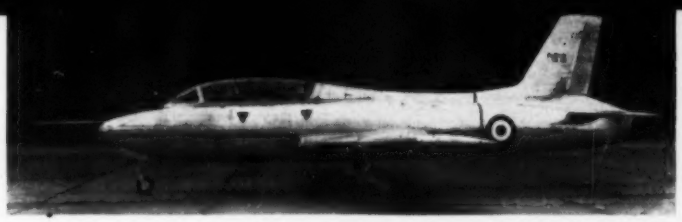
A large proportion of all G 91s to be built will be of the G 91R type with a special nose housing one vertical and three oblique reconnaissance cameras in addition to the standard armament.

The G 91 has a Messier undercarriage, Pirelli tyres, Martin-Baker Mk 4 lightweight ejection seat and Oerlikon rocket packs. Controls are fully powered and a Lear yaw-damper is to be fitted. The rear, front and floor of the cockpit and a large portion of the underside of the fuselage are protected by armour plate, and the rear portion of the fuselage may be detached for access and replacement of the engine. The canopy is of the clam-shell type.

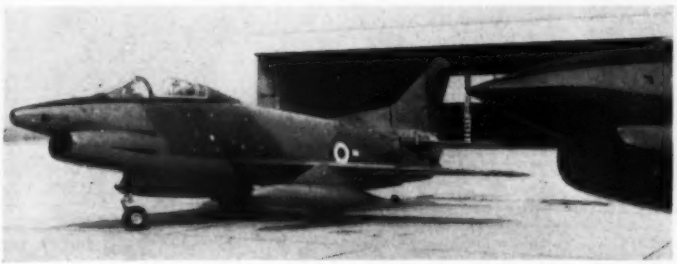
Span, 28ft 1in; length, 33ft 8in; wing area, 176.7 sq ft; empty weight, 6,700lb; gross weight, 11,465lb; max level speed, 565kt; stalling speed, 125kt; climb to 26,000ft 7min 45sec; service ceiling, 40,000ft; take-off to 50ft, 3,870ft; landing from 50ft, 2,020ft; typical low-level strike radius, 150 n.m.

Fiat G 91T The prototype of the tandem two-seat trainer version of the G 91 made its first flight little over a month ago and a production

Macchi MB.326



MILITARY AIRCRAFT OF THE WORLD . . .



Fiat G 91R

Right, Fiat G 91T

Fiat 7002

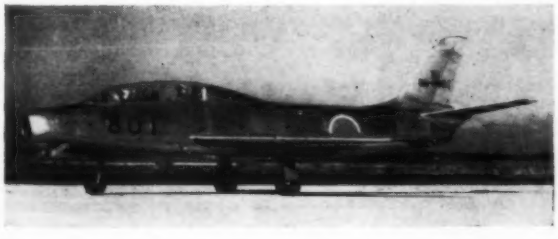
order has been placed by the Italian air force. Fixed armament is reduced to two 0.5in machine guns in two packs flanking the cockpit. Empty and gross weights are slightly increased but performance is substantially the same as that of the fighter. The powerplant remains a Bristol Siddeley Orpheus 803. The G 91T is publicized as a cheap, simple trainer for both basic and operational training, capable of operation from grass fields and of carrying a standard armament load. Both occupants have Martin-Baker Mk 4 lightweight ejection seats. A camera nose is fitted to the prototype.

Span, 28ft 3in; length, 39ft 5in; wing area, 176.7 sq ft; empty weight, 7,100lb; gross weight, 11,775lb; max level speed, 550kt; stalling speed, 125kt; climb to 26,000ft, 8min; service ceiling, 40,000ft; take-off to 50ft, 4,000ft; landing from 50ft, 2,100ft; range, 700 n.m.

Fiat G 95 Fiat have recently obtained a patent for an STOL propulsion system based on two auxiliary turbojets of high thrust/weight ratio, designed to provide both take-off boost and reverse thrust for landing. Various layouts are proposed, divided into three main categories. In the first the two auxiliary engines are mounted below and beside the main engine and provided with swivelling nozzles to direct thrust either rearwards or forwards. In the second, the auxiliary engines are mounted on a frame attached to the main engine and arranged to swivel in such a way that their jetpipes emerge beneath the fuselage to thrust rearwards and slightly downwards. In the third layout the auxiliary engines are fixed and gases may be vented through three special nozzles intended to produce reverse, downward or rearward thrust directly through the c.g. of the aircraft. One of these three arrangements—though it is not clear which—is to be incorporated in a proposed STOL development of the G 91, designated G 95. The preliminary artist's impression published abroad purports to show that the G 95 will have a swept mid wing and both nose and flank intakes and a single efflux at the tail. The flank intakes presumably serve the secondary engines, their jet pipes being covered during normal cruising flight. The tail of the G 95 appears to be much like that of the G 91, but the later aircraft appears to be somewhat larger and heavier than its predecessor.

The advantages of this propulsion system are that all engines use the same fuel, that the boost engines provide both thrust for take-off and drag for landing and that they can be used for combat boost or as auxiliaries in the event of failure of the main engine. It is reported that the G 95 will have a take-off run of only 490ft and a range of 1,870 miles. A thrust/weight ratio of 16 : 1 has been mentioned for the boost engines and it might be deduced that these will therefore be provided by Rolls-Royce.

Fuji T1-A



Fiat Model 7002 Noteworthy for the simplicity of its construction and maintenance, the Fiat 7002 helicopter has a tilting two-blade rotor driven by cold tip-jets supplied by a turbo compressor driven by a Fiat 4700 turbine. A small ducted tail rotor ensures directional control at low speeds. The egg-like fuselage contains fuel tanks immediately below the rotor head, the load compartment for up to five occupants on the c.g., the two-seat cockpit in the nose and the engine compartment at the rear. Both military and civil applications are foreseen.

Rotor diam, 39ft 4in; fuselage length, 20ft; empty weight, 1,320lb; gross weight, 3,085lb; cruising speed, 84 m.p.h.; service ceiling, 11,150ft; range, 188 miles.

Macchi MB.326 A pre-production batch of these tandem two-seat trainers is being built and between 80 and 100 may be ordered for the Italian air force. Exports are being sought. Powerplant is a Bristol-Siddeley Viper 11 of 2,450lb thrust which will possibly be produced under licence by Piaggio. Armament may be fitted.

Span, 32ft 11in; length, 34ft 5in; empty weight, 5,026lb; gross weight, 7,429lb; max speed at 19,700ft, 506 m.p.h.; stalling speed, 97 m.p.h.; service ceiling, 41,000ft; take-off to 50ft, 1,970ft.

Japan

Fuji T-1B This is to be the designation of the first all-Japanese military aircraft for the Japan Air Self Defence Force. It is reported that 90 of these aircraft, powered by the Nippon Jet Engine Co J3-1 engine giving 2,645lb static thrust have been ordered for delivery during 1961-63. They will replace T-6G Texans which, in the military training scheme, are used between T-34 Mentor primary stage and T-33 advanced stages.

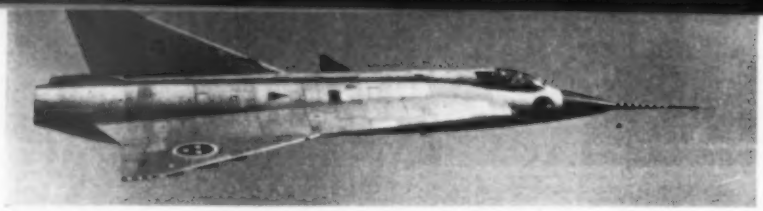
Because the airframe was developed exceptionally quickly—only 16 months elapsed between the placing of the order and the emergence of the first prototype—the Japanese engine was not ready in time and two prototypes and three pre-production aircraft have been powered with Bristol Siddeley Orpheus BOr.1 of 4,050lb thrust or Orpheus 100 of 4,230lb thrust. An initial production batch of 20 T-1As powered by Orpheus 805 engines of 4,000lb thrust is to be completed by the end of this year and 32 of these engines have been ordered. Manufacturers' designations of the T-1A and the T-1B are respectively T1F2 and T1F1.

Instructor and pupil are accommodated in ejection seats beneath a clam-shell canopy and flanked by the ducts from the nose intake to the engine in the rear fuselage. Some 308gal of fuel are accommodated in the wings and fuselage and two 100gal underwing tanks may be added. A single 0.5in machine gun may be mounted in the nose; and gun packs, bombs, Napalm or Sidewinder missiles may be attached under the wings, to a maximum load of 1,500lb. Controls are not powered and the Fowler-type flaps are double slotted inboard. An air-brake opens from beneath the cockpit section.

Span, 34ft 5in; length, 39ft 9in; wing area, 239 sq ft; empty weight, 5,313lb; normal gross weight, 8,800lb; max gross weight, 10,700lb; max speed, 557 m.p.h. at 20,000ft; max range, 783 miles; initial climb 6,100 ft/min; service ceiling, 40,000ft; max endurance, 2.76hr.

Netherlands

Fokker F.27 military projects A swing-tail, rear-loading version of the Freightship/Troopship military F.27s is being considered by Fokker. Also mooted by Fairchild and Fokker is the F.27S STOL version with Rolls-Royce Dart RDa.8s giving 2,460 s.h.p. each and double-slotted flaps and interconnected variable-incidence tailplane.



Left, Saab J35B Draken

Below left, Saab J32B Lansen

Below, Saab 35C Draken

MILITARY AIRCRAFT OF THE WORLD . . .

Sweden

Saab J35A Draken With distinctive double-delta wing, and powered by Rolls-Royce Avon 200 series engine and a Swedish afterburner, built under licence by Svenska Flygmotor as the RM6B, the first production Drakens are now reaching Swedish Air Force fighter wings. A small force of Drakens operated with F13 Wing at Norrköping during a major air defence exercise in March.

With 11,000lb thrust "cold" and 15,000lb with afterburner, the Draken can attain M1.8 in level flight and has an initial rate of climb of 39,300ft/min. Fixed armament consists of two 30mm revolver cannon in the inner wings which may be replaced by additional internal fuel tanks. Air-to-air armament includes Sidewinder, standardized by the Swedish Air Force, or packs of unguided rockets. For the ground-attack role six Bofors 13.5cm air-to-ground rockets or bombs may be mounted on under-wing pylons. The nosewheel undercarriage retracts in four seconds, the main legs shortening and folding outwards. Retractable twin tailwheels are also fitted. Double disc brakes with anti-skid units, a braking parachute and exceptional low-speed characteristics allow a landing speed of 130 m.p.h. and ground-run of less than 2,000ft. The sweep on the inner wing is no less than 80° and that on the outer wing 57°. Wing area is 538.2 sq ft. Pairs of control surfaces on the trailing-edge of each wing act as elevons, each surface being operated by tandem jacks fed by two separate hydraulic supplies and a ram-air turbine standby. A Lear autopilot is fitted.

Span, 30ft 10in; length, 53ft 4in; gross weight, between 17,600lb and 19,800lb; max speed, M1.8; initial climb, 39,300ft; stalling speed, 130 m.p.h.; minimum landing run, 1,970ft.

Saab J35B Draken Scheduled to supplement the J35A in the Swedish Air Force and also offered for export, the J35B Draken has a rear fuselage enlarged to accommodate a much bigger Svenska Flygmotor afterburner attached to a Rolls-Royce RB.146, itself much more powerful than the Avon 200 series. Initial rate of climb is 50,000ft/min and M2 has been exceeded in level flight. RSAF versions will have the Saab S7 collision-course fire-control, but export versions are offered with Ferranti Airpass 2 attack and interception radar. The new Draken will have two separate communications radios, a modern data link and two navigation systems, one of which is electronic and the other the ABR dead-reckoning set. Flight instruments include vertical, linear scale indicators. Dead-reckoning information will be presented on the radar screen in the ground-mapping mode.

The J35B was announced in November 1958 and first flew late last year. External and internal armament combinations are the same as those of the J35A and external dimensions are substantially unaltered.

Saab 35C Draken This tandem, two-seat trainer version is based on the J35A, the space taken by the rear cockpit having been provided by simplification of certain equipment. The instructor's seat is somewhat higher than that of the pupil to afford good visibility. Performance is substantially the same as that of the J35A and the fighter nose is interchangeable with the two-seat unit. The first J35C flew on December 30 last year and the type is already in production for the RSAF, the first example being due later this year. It will be employed in a centralized operational training school.

A.F.A. P-16 Mk III

Saab A32A Lansen Several hundred Lansens were supplied to the 12 attack squadrons of the RSAF and production ceased in the middle of 1958, making way for the later, more specialized versions. The A32A is a swept-wing, tandem two-seat attack aircraft powered by a Rolls-Royce Avon RA.7 made by Svenska Flygmotor as the RM5 and fitted with a Swedish afterburner. It can attain M0.9 in level flight, is supersonic in a dive and has a navigation and fire-control radar and four fixed 20mm cannon. Bombs, rockets and Type 304 air-to-surface missiles may be carried externally.

Span, 42ft 8in; length, 49ft 2in; empty weight, 15,400lb; gross weight, about 22,000lb; max speed over 700 m.p.h.; landing speed, 125 m.p.h.; service ceiling, about 50,000ft.

Saab J32B Lansen With the Rolls-Royce Avon 200 series built by Svenska Flygmotor as the RM6 and fitted with an enlarged Swedish afterburner, the J32B is a specialized night fighter and can attain M1 in level flight. It is stated to have more powerful armament, including Sidewinders, and new navigation and fire-control equipment. External dimensions and appearance are substantially the same as those of the A32A but rate of climb and speed are considerably improved. A substantial number of J32Bs have been supplied to the RSAF.

Saab S32C Lansen Although basically the same as the A32A, the S32C has been specially adapted to carry cameras mounted in the nose alongside the nosewheel bay as well as special equipment to permit photography by night from a wide range of altitudes. Electronic equipment for night navigation and radar reconnaissance is fitted. A considerable number of this variant have been supplied to the RSAF.

Saab 91 Safir More than 300 Safirs of various types have been built since 1945 and production continues. Three versions are available, the 91B with 190 h.p. Lycoming engine and three seats, and the 91C and 91D four-seaters, respectively with 190 h.p. and 180 h.p. Lycoming engines. The Safir is flying in 17 countries. Data are for the 91D.

Span, 34ft 9in; length, 26ft; empty weight, 1,620lb; gross weight, 2,657lb; max speed, 165 m.p.h.; cruising speed, 146 m.p.h.; service ceiling, 16,400ft; cruising range, 660 miles.

Switzerland

A.F.A. P-16 Mk III Original plans for production of this specialized, single-seat attack aircraft for the Swiss Air Force were abandoned about two years ago, but the new company, Aktiengesellschaft Für Flugzeugunternehmungen Altenrhein, took over the design last year and has produced the P-16 Mk III, embodying numerous modifications, which is proposed for production. Designed specially for operation in Switzerland from small fields high up in narrow mountain valleys, the P-16 has special leading- and trailing-edge high-lift devices, is powered by a Bristol Siddeley Sapphire Sa.7 engine and has an internal armament consisting of two HS.825 30mm guns in the nose and a pack of 44 6.5cm air-to-air rockets. Four underwing pylons can accommodate 1,000lb bombs, 100gal fuel or Napalm tanks, rocket packs, camera containers or homing missiles. Internal fuel capacity is 656gal. Tacan, radar-ranging gun-sight, IFF, yaw damper and target camera are fitted.

Span, 36ft 7in; length, 46ft 9in; wing sweep, 12° at quarter chord; wing area, 323 sq ft; empty weight, 15,500lb; normal gross weight, 20,475lb; max gross weight, 25,800lb; max military load, 5,720lb; max sea-level speed, 700 m.p.h.; min stalling speed, 112 m.p.h.; initial climb, 12,800ft/min; service ceiling, 46,000ft; max combat radius, 230 miles.

Pilatus P-3 Although flight testing was completed some years ago, production of this tandem two-seat trainer powered by 260 h.p. Lycoming engine only began comparatively recently, a batch of 60 having been ordered for the Swiss Air Force. The P-3 has a nosewheel undercarriage and can carry a single machine gun, two practice bombs or rockets beneath the wing for weapon training.

Span, 34ft 1in; length, 28ft 8in; equipped weight, 2,447lb; gross weight, 3,120lb; max speed, 192 m.p.h.; cruising speed, 170 m.p.h.; stalling speed, 62 m.p.h.; service ceiling, 18,000ft; range, 465 miles.

Coventry this Weekend

AEROBATICS, AIR DISPLAYS AND AIR RACING

TODAY and tomorrow Baginton Airport is again the scene of the British Lockheed International Aerobatic Trophy and the King's Cup air race. Entered in the former are competitors from six different countries including, for the first time, the USA. The air races complete the season that started with the London to Cardiff air race on June 3 and the National Air Races which followed at Rhoose Airport.

From points awarded in the Cardiff races (reported in our issue of June 17) have been selected the 24 pilots taking part in the King's Cup around four laps of an 18-mile course. Leading at the moment is J. Stewart Wood who, in an Auster V, won the London to Cardiff race; second is Sheila Scott who has had a particularly successful season with her Thruxton Jackaroo *Myth*.

The entry list for the Lockheed International Trophy promises that the standard of aerobatics to be seen today will be better than ever. Competing against American entrants Frank D. Price and T. J. Chandler with their Great Lakes 2T/A trainer (N.11339) are five British competitors, five each from France and Czechoslovakia, two from Switzerland and one from Germany. With the exception of H. R. Lane, who is to fly Currie Wot G-APWT, all the British entrants—J. R. Ayers, P. J. C. Phillips, M. D. Popoff and C. Boddington—are to fly either the Archbishop (G-ANZZ) or the Deacon (G-AOAA) Tiger Moths. Czechoslovakia has entered five Morava Z-226 Akrobats to be flown by Jirina Lockerova, Zdenek Beseda, Antonin Klimenda, Eva Krencova and Jurac Souc and the Stampe SV 4, in various marks, figures largely among the French entries. Leon Biancotto may fly a Nord 2302. His team mates are G. J. Verette, Mme Elisabeth Cormouls-Houles, M. Charollais and Chevalier J. d'Orgiex. Flying again for Switzerland is F. Liardon, last year's winner, in Bücker 133 Jungmeister HB-MIC. His compatriot A. Ruesch is to fly Morava Z-226 HB-ASF. Finally, from Germany comes G. H. Pawolka, who will fly either a Dornier Althenrein or a Bücker 131 Jungmann.

Six competitors will fly in the finals at 1425hr tomorrow afternoon after eliminating rounds this morning and after lunch. Practice for the King's Cup race takes place between 1630hr and dark today and tomorrow morning until the first items of the traditional Coventry air display begin at noon. The King's Cup will be flown off between 1600 and 1645hr. Interspersed between these events will be further items in the display. Coventry Airport is open to the public both today and tomorrow but arrivals of visiting aircraft tomorrow will be restricted to the period between 1230 and 1400hr.

KING'S CUP RACE ENTRIES

No	Pilot	Aircraft and engine	Reg'n	Pts§	Champ Pos'n
34	J. Stewart-Wood	Auster V (Lycoming 0-290-3/1)	G-AIKE	62	1
52	Miss S. Scott	Jackaroo (Gipsy Maj 1)	G-APAM	56	2
53	G. C. Marler	Jackaroo (Gipsy Maj 1)	G-APAP	56	2
7	J. de M. Severne	Turbulent (Ardem 4CO2)	G-APNZ	54	4
22	B. J. Snook	Tiger Moth (Gipsy Maj 1)	G-ANZZ	50	5
63	G. P. Watson	Proctor 3 (Gipsy Qn 2)	G-AOEJ	48	6
36	R. W. Bowles	Auster AOP 6 (Gipsy Maj 7)	VF 544	48	6
80	P. Blamire	Gemini 3c (Gipsy Maj 10)	G-ALZG	46	8
65	A. S. K. Paine	Proctor 1 (Gipsy Qn 2)	G-AHNA	44	9
21	C. A. N. Bishop	Tiger Moth (Gipsy Maj 1)	G-ACDC	44	9
5	C. Gregory	Taylorcraft Plus D (Cirrus Min)	G-AHGZ	42	11
24	Miss G. M. Cazalet	Tiger Moth (Gipsy Maj 1)	G-APNK	42	11
18	C. E. Elton	Tiger Moth (Gipsy Maj 1)	G-ARAZ	40	13
43	W. H. Bailey	Hawk Trainer 3 (Gipsy Maj 1)	G-AIUA	40	13
2	C. P. Francis	Turbulent (Ardem 4CO2)	G-APZZ	40	13
64	A. J. Spiller	Proctor 3 (D.H. Gipsy Qn 2)	G-AHEK	38	16
17	J. H. Denyer	Auster J 1.N (Gipsy Maj 1)	G-AJEH	36	17
14	L. J. Benjamin	Tiger Moth (Gipsy Maj 1)	G-AOAA	36	17
59	C. W. Hubbard*	Prentice (Gipsy Qn 32)	G-AOLP	34	19
31	P. G. Statt†	Moth Minor (Gipsy Min)	G-AFOZ	32	20
67	K. B. Neely	Proctor 3 (Gipsy Qn 2)	G-AOGE	30	21
85	E. Crabtree	Gemini 3c (Gipsy Maj 10)	G-AKEG	30	21
46	D. W. Phillips	Linnet (Cont C-90-14F)	G-APNS	24	23
96	R. R. Paine‡	Hawk Speed Six	G-ADGP	22	24

*Reserve aircraft in Class II. †Reserve aircraft in Class III. ‡Reserve aircraft in Class I.

§Points are those gained in the three classes which comprised the entry for the London - Cardiff race and in the three short circuit class races at Cardiff, plus bonus points awarded for overall finishing positions in the London - Cardiff race.

"Flight" photographs

Racing, aerobatics and an air display are the fare at Baginton today and tomorrow. Two Turbulents (as above) participate in the King's Cup while aerobatic entries include (below, left) the Jungmeister flown by F. Liardon, last year's winner, and the Archbishop Tiger (below, right), mount of four out of five of the British competitors. The exception (right) is a newcomer to Coventry, the Currie Wot

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Farnborough—and no Fleet Air Arm

LIKE many other ex-Fleet Air Arm officers, I listened with a thrill of pride to Margot Campbell's recent BBC feature *Find, Fix and Strike*. A chance conversation in the train the next morning, however, brought me crashing back to earth. "Your chaps are not going to Farnborough this year, I hear," said my travelling companion—"pity." Mere regrets apart, this is a serious step and the reasons for their Lordships taking it must be serious, if not even disquieting.

It is only three years ago that, after many years out in the cold as Cinderella of the Services, the Fleet Air Arm went on show at Farnborough. What an impression those scarlet Sea Hawks of 738 made!—not to mention the "anchor" of Gannets or the delight of the public at the square-dancing helicopters. In 1958 Sea Hawks again and Norman Perrett's classic call, "Finals 27 greens"—this boosted by the first squadron of Scimitars sweeping over at 0.9-plus (plus quite a lot!). Last year the "dart" snatch and the two-way landing. All these kept the Royal Navy well in the public eye. But now we quietly bow out of the finest shop-window for both Service and national prestige with nothing more than an almost meaningless Civil Service excuse.

What is left? No Lee, no Ford, nothing nearer to the Home Counties and London than Yeovilton (115 miles). Apart from my own wish to see my Service performing there are thousands of taxpayers with no chance, pending the formation of the RAF's first Lightning squadron, to see Britain's newest, most powerful and most up-to-date fighters—let alone to be reminded of the very existence of the Fleet Air Arm.

Lest people who know the concern by whom I am employed think I have some axe to grind I must regretfully remain,

London W1 VOX NAUTICUS

Co-operative Supersonic Airliner?

THIS country is going to have to decide soon how to enter the supersonic transport field. On the one hand, there is the question of national prestige and technical know-how to be gained, and on the other is the difficulty of selling enough supersonic airliners to show a profit. To gain the best of both worlds it seems advisable to collaborate with either the Americans or with Continental Europe. The question arises, how?

America will certainly build supersonic airliners, and as in the case of the Boeing 707 and DC-8 some duplication will probably emerge. This will make it more difficult for a British firm to compete in the American market, the largest market in the world. Apart from home sales, the other large market is with the European countries and their national airlines. But the European industry is sufficiently strong and nationalistic (within the "six") to build its own supersonic airliner.

More than one type of airliner will be needed, one for long range (707 and DC-8 replacement) and the Atlantic route, and at least one other for medium ranges of 1,000 to 2,000 miles. The latter would need to be economic down to 300 miles or even less, although the turboprop will compete on more than equal terms for a long time to come for the shorter ranges. The two great aircraft companies in this country are probably technically able to build two supersonic airliners—say of Mach 3 and Mach 1.5 for the long and medium ranges—but with American and European competition would never be able to sell sufficient to recover even a small part of the enormous cost.

However, if we collaborated with *both* the Americans and with Europe we would have a foot in both sales markets and also be able to participate in building both the main types of supersonic airliner.

A typical arrangement might be for Hawker Siddeley to collaborate with one of the giant American firms (Boeing, Douglas, Lockheed?) to build an Anglo-American long-range supersonic transport. Such an aircraft would find most of its sales in the USA, as have the 707 and DC-8. The American firm might find it worthwhile to collaborate with a British firm, as that would practically guarantee a number of sales to BOAC and other Commonwealth airlines, and increase chances of sales even in Europe, since some of the aircraft would be manufactured on Europe's doorstep—in this country. While the main effort of design and testing might be American, the considerable resources of Hawker Siddeley would contribute a large part of the work and perhaps a Bristol Siddeley Olympus engine could be used. The long-range Anglo-American supersonic airliner would probably have to compete with a rival all-American consortium, or even a US-French concern.

The other link-up might be by the BAC and French and other European companies. The Vickers experience in medium-range airliners would be very useful for extrapolation to medium range supersonic airliners, and Rolls-Royce engines would continue the present happy association. The European market for such an aircraft will be quite considerable and the wasteful competition such as occurred between Comet 4 and Caravelle would be eliminated. The designing could be shared, as it already is, by different companies on one aeroplane—e.g., wings by Sud-Aviation, engine mountings and tail by BAC, etc. A factory in Britain would build aircraft for the British Commonwealth and North America, and a factory in France build them for Europe and the rest of the world. Parts would be made in all the member countries of such a co-operative venture.

Some such set of schemes as those outlined would ensure that British aeronautical engineering was still out in front and yet ensure that we get our fair share of sales despite nationalistic barriers. British engines could be used wherever possible, thus ensuring we have some major stake in whichever supersonic airliner is successful.

Sheffield 10 A. G. FRANKLIN

The Croydon Celebrations

From Air Cdre A. H. Wheeler, CBE, MA, FRAeS, trustee (aviation), the Shuttleworth Collection.

IN your note on the Croydon millenary celebrations (page 857, June 24), after making complimentary mention of the Shuttleworth Trust aircraft you go on to deplore an "opportunity glaringly missed." Readers may be interested to learn of the circumstances leading up to this situation.

The original suggestion put up for the exhibition on the aviation side (by the Shuttleworth Trust) was for four separate tableaux, each one representing a scene on Croydon Aerodrome at a certain period in its history. Each tableau was to have a background photograph (if obtainable) of the period and the group would include contemporary vehicles and people in the dress or uniform of the time. The periods we selected were:—

(1) The earliest in Croydon's history, with the oldest aeroplanes we have, and cars of that time.

(2) The mid-1914-18 period, with our Bristol Fighter, Pup, Avro 504K, etc.

(3) The between-wars period *circa* 1927, with our light aeroplanes —D.H. 53, English Electric Wren, D.H. Moth, etc., illustrating the early sporting aeroplanes.

(4) The World War II period with the Supermarine Spitfire, Hawker Hurricane and Gloster Gladiator.

This rather ambitious display, although agreed by the organizers of the exhibition, became impractical when they failed to obtain permission to fly the later aircraft into Croydon—even our Bristol Fighter came under the Ministerial ban, although the Croydon authorities asked that permission should be given. Transport of these aircraft by road, with the essential dismantling and re-rigging, would have made the cost prohibitive.

Under these conditions Tableau 4 was out and time was too short to improvise some other arrangement. Although the Shuttleworth Trust provided the aeroplanes and suggested the scheme described above they had no hand in the actual arrangements for the display.

In conclusion, and after hearing comments by some of the visitors to the aviation display, I can reassure you that Croydon's connection with aviation was well appreciated—it is the severance of that connection which still needs a proper explanation.

Twyford, Berks ALLEN WHEELER

[In the following week's issue we were able to record that permission was eventually obtained for a farewell fly-past by club aircraft.—Ed.]

FORTHCOMING EVENTS

July 2-10. West Aero Club of France: Gliding Competition, Angers.
July 7-10. International Light-aircraft Show, Venice.
July 8. RAeS Astronautics and Guided Flight Section: a.g.m. and Lecture: "The US Space and Astronautics Programme," by Capt Robert F. Freitag, USN.
July 8. College of Aeronautics: Presentation Day and Ball.
July 8-9. Royal Aero Club: Lockheed International Aerobatic Competition and King's Cup Race, Baginton, Coventry.
July 8-10. Italian Aero Club Competition.
July 9. RAFA and Exeter Airport Ltd: Display, Exeter.
July 9-10. Basse Normandie Aero Club Rally, Flers.
July 10. Elstree Flying Club Pilot's Rally, Elstree Aerodrome.
July 10. Leicestershire Aero Club At Home, Leicester East/Oadby.
July 16. Parachuting Competition, Woburn Abbey.
July 17. Royal Aero Club Rally, Woburn Abbey.
July 23. Army Air Corps: Open Day, Middle Wallop, Stockbridge, Hants.
July 23-24. Trento Aero Club: 10th Aerial Circuit of the Dolomites.
July 24-August 1. Gliding Weeks: Yorkshire GC., Sutton Bank; London GC., Dunstable; Coventry GC., Edge Hill (opens July 23).
July 30-August 7. Inter-Services GC.: Gliding Week, Lasham.
July 31-August 7. Bulgarian Aero Club: World Parachuting Championships, Mousatchevo, near Sofia.